

Seismic Processing Workshop™

SPW™

V 3.0
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Parallel Geoscience Corporation

About This Manual

This manual is organized into two sections. The first section is a user's manual for the SPW Flowchart application. The second section is a reference manual that describes each of the processing steps and associated parameters in the SPW Processing library.

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Seismic Processing Workshop™	1
SPW™	1
About This Manual	2
Introduction to SPW	9
Product Support	10
SPW Flowchart Version 3	11
SPW 3 Installer Available Online	11
Installing SPW 3 on Windows	13
SPW 3 User Directory	18
Creating or Selecting a Project	20
SEG Y Processing Format	26
Main Flowchart Window	30
Tool Bar	31
Selection Tool	32
Linking Tool	33
Delete Tool	33
Select All Tool	33
Undo Tool	34
Redo Tool	34
Processing Categories	35
Processing Steps Lists	36
Console Display	37
Menu Items	38
The FlowChart Menu	39
SEG Y Analyzer	40
The Processing Menu	Error! Bookmark not defined.
The Seismic Display Menu	52
The Attribute Map Menu	53
The Survey Menu	56
The Picking Menu	57
The Spectral Decomposition Menu	58
Building Processing Flows	59
Setting Processing Step and Data Step Parameters	60
Displaying Seismic Data	61
The Seismic Display	63
Seismic Display Control Panel	64
Left Side of the Seismic Display Control Panel	64
Center of the Seismic Display Control Panel	65
Select Sort Key Number	66
Center of the Seismic Display Control Panel Tools	Error! Bookmark not defined.
Capture an Image Tool	67
Select Color Scale Tool	68
Create Color Scale Tool	69
Zoom In Tool	70
Zoom Out Tool	70
Sort Data Tool	67

Trace Amplitude Spectra Tool.....	71
Area Amplitude Spectra Tool	71
Propagate Display Setting Tool	71
Synchronize Scrolling Tool	71
Delete a Pick Tool.....	71
Additional Display Parameters Tool.....	72
Right Side of the Seismic Display Control Panel	Error! Bookmark not defined.
Displaying Seismic Headers Spreadsheets	73
Map Displays	74
The Basemap.....	77
Displaying a Survey Basemap	78
Base Map Display Control Panel.....	81
Attribute Maps	83
Interactive CMP Bin Definition.....	84
Displaying Survey Fold Map.....	85
Displaying Spreadsheets of Auxiliary Data.....	87
Early Mute Functions.....	88
Receiver Statics.....	89
Source Statics.....	90
Velocity Functions.....	91
Running the Flowchart.....	100
Naming and Saving a Flow	100
Executing a Flow inside the Flowchart.....	101
Executing a Flow on a Cluster	102
Instantaneous Field QC Capabilities and Procedures	103
Real Time Processing	104
Real Time Seismic Displays	106
Real Time Map Displays	107
FTP Connection	108
Sending Reports via FTP in Real Time	110
Sending Image Files via FTP in Real Time	112
The Processing Library:.....	113
Overview.....	113
Amplitude Adjustment Steps	115
Amplitude Equalization	116
**Amplitude versus Angle	Error! Bookmark not defined.
**Angle Gather.....	Error! Bookmark not defined.
Apply Gain.....	120
Apply Trace Balance.....	Error! Bookmark not defined.
Automatic Gain Control.....	122
Clip.....	124
**Remove AGC.....	Error! Bookmark not defined.
**Sliding Window AGC.....	125
Spherical Divergence Correction.....	128
Surface Consistent Amplitude Corrections.....	Error! Bookmark not defined.
**Trace Balance.....	Error! Bookmark not defined.

Trace Header Amplitude Math	131
**Windowed AGC.....	Error! Bookmark not defined.
Windowed Trace Balance	133
Card Data Steps.....	135
Creating and Editing Card Data Files	137
Card Data Customization Dialog.....	144
Creating Card Data in Excel	149
Crooked Line Bin Definition	150
CMP Statics	153
Early Mutes.....	155
First Break Time Picks.....	158
Frequency Filter	161
GMG Source Card File	164
GMG Station Card File.....	165
Gain Curves	167
Horizon File	170
Line Definition File.....	173
Multicomponent Receiver Statics File.....	175
Observers Notes – SPS Format.....	178
Phase Matching Statistics File	181
Polygon Definition File	183
PP Nhmo Eta Function	185
PP Nhmo Gamma Function	188
Profile Geometry File	191
Receiver Gains	194
Receiver Locations – SPS Format	197
Receiver Statics.....	200
Receiver Statics List	203
Refractor Velocities	205
Residual NMO Analysis	208
Rotation Card File.....	211
Source Gains	214
Source Locations – SPS Format	217
Source Statics.....	220
Source Statics List.....	223
Streamer Definition.....	225
Surgical Mutes	228
Tail Mutes	231
Time Filter	234
Trace Kills.....	236
Trace Reversals.....	239
Trace Statics.....	242
Velocity Function.....	244
Display Steps	247
Editing Steps.....	252
Automatic Trace Edit.....	253

Coordinate Conversion	Error! Bookmark not defined.
Data Difference	255
Data Divide	Error! Bookmark not defined.
Data Multiply	Error! Bookmark not defined.
Data Sum	Error! Bookmark not defined.
Derivative	309
Design Vibroseis Sweep	Error! Bookmark not defined.
Despike	Error! Bookmark not defined.
Duplicate Trace	Error! Bookmark not defined.
Integration	324
Kill Traces	257
Phase Rotation	259
Remove DC Bias	261
Reverse Traces	265
Trace Header Cell Math	266
Trace Header Column Math	270
Trace Header Logic	273
Trace Header Resequencing	277
Trace Math	279
Vibroseis Correlation	281
Filtering Steps	284
Adaptive Filter	285
Adaptive Radon Demultiple	288
Apply F-K Filter	292
Apply F-K Velocity Filter	295
Apply Frequency Filter	299
Apply Time Filter	301
Butterworth Filtering	303
Coherence Filter	305
Convolution	307
Design Frequency Filter	Error! Bookmark not defined.
Design Notch Filter	Error! Bookmark not defined.
Design Time Filter	Error! Bookmark not defined.
Diffusion Filter	309
Dip Filter	313
F-K Spectrum	316
F-X Deconvolution	318
F-XY Deconvolution	320
Horizontal Median Filter	322
Median Filter	327
Notch Filter	329
Q Filter	332
Radon Demultiple	335
Radon Transform	338
Radon Inverse	342
Ricker Filter	345

Spatial Noise Filter	347
Swell Removal	349
Time Variant Bandpass	351
Time Variant Butterworth	353
Wave Equation Multiple Attenuation	355
Geometry/Binning Steps	357
Note Trace Header Geometry Application	358
Build Supergathers	362
CMP Binning	365
CMP Fold - Data	368
CMP Fold - Geometry	370
Crooked Line Binning	373
Crooked Line Fit	375
Extract Geometry	377
Flex Binning	379
Geometry Definition	381
Geometry Interpolation	390
PreStack Kirchhoff Partitioning	392
Simple Marine Geometry	394
Single Fold Profile Geometry	396
UKOOA P1/90 Geometry	399
Image data	401
F-T Frequency Slice Image	404
F-T Time Slice Image	406
Migration	408
2-D Dip Moveout	409
Create Simple Geometry from XY's	411
Convert Time to Depth	414
Finite Difference Migration	416
Kirchhoff Dip Moveout	418
Phase Shift Migration	421
Post-Stack Kirchhoff Time Migration	423
Pre-Stack Kirchhoff Time Migration	426
Split-Step Migration	433
Stolt Migration	435
Multi-Component	437
Apply Horizontal Rotation	439
Apply PS Non-hyperbolic Moveout	441
Birefringence Analysis - 2C	444
Birefringence Analysis - 4C	447
CCP Binning	449
CCP Fold - Geometry	452
Constant Gamma Stacks	455
Convert PS Time Picks	458
Dual Summation	460
Horizontal Rotation	462

Select Component	464
Three Component Rotations	466
Two Component Horizontal Rotation.....	469
Wavefield Separation.....	473
Mutes.....	475
Apply Surgical Mute.....	478
Apply Tail Mute.....	480
Quality Analysis.....	482
Amplitude Analysis	483
Amplitude Spectrum	486
Autocorrelation	488
Compare Traces	490
Cross Correlation	492
Extract Dead Traces.....	494
F-T Cube	496
F-T Frequency Slice.....	498
F-T Time Slice	500
Frequency Analysis.....	502
Gabor Transform.....	505
Instantaneous Amplitude	507
Instantaneous Frequency.....	509
Instantaneous Phase	511
Phase Matching.....	513
Resolution	515
Signal to Noise.....	517
Source Energy Estimation.....	519
Trace Analysis Report.....	521
Trace Header Maps	523
Seismic Data	525
3D Radar File.....	526
ARAM SEG Y File.....	528
Brick 2D Data	530
Copy Seismic File.....	532
Create Sine Waves	535
Create Spikes	537
F-X Trace Interpolation	540
I/O SEG Y File.....	542
Interpolate Traces.....	544
Progress T2 SEGD File.....	546
Resample Seismic	548
SEG 2 File.....	550
SEG Y File.....	553
Seismic File.....	556
SPW Demo File	559
Seismic Merge	561
Sercel SEGD File.....	563

Signature Input.....	565
Sorting Steps	567
CMP Sort	568
General Trace Sort	570
Offset Sort.....	575
Receiver Sort.....	577
Select Traces	579
Source Sort.....	581
Stacking and Summing Steps.....	583
Diversity Stack.....	587
Horizontal Trace Sum	589
Median Stack	591
Receiver Order Stack	595
Source Order Stack	597
Trace Mixing.....	599
Variable Trace Mix	601
Statics Steps	603
Apply GMG Statics.....	604
Apply Static Shifts	607
Automatic Residual Statics	609
CMP Statics Separation	611
CMP Statics Summing.....	613
Flattening Statics.....	615
Floating Datum Statics.....	617
Receiver Statics Separation.....	619
Receiver Statics Summing	621
Refraction Statics	623
Source Statics Separation.....	625
Source Statics Summing	627
Stack-Power Optimization Statics	629
Surface Consistent Statics.....	633
Trim Statics	637
Velocities	639
Apply Linear Moveout.....	640
Apply NMO	642
Apply PP Non-hyperbolic Moveout	645
Azimuth Velocity Analysis.....	648
Calculate 3-D Residual NMO	652
Constant Velocity Stacks	655
Delta-T Stacks.....	658
Delta-T Velocities.....	661
Dix's Equation	662
PP Constant Eta Stacks	664
Supergather Velocity Analysis	667
Velocity Cube	670
Velocity Semblance	672

Velocity Smoothing	675
Wavelet Shaping Steps	678
Apply Deconvolution Operators	679
Deconvolution.....	681
Minimum Phase Compensation	684
Offset Deconvolution.....	687
Receiver Deconvolution.....	690
Source Deconvolution.....	693
Signature Deconvolution	696
Spectral Whitening.....	699
Surface Consistent Deconvolution.....	702
Time-Variant Deconvolution	705
Wavelet Estimation – Seismic Only	708
Wavelet Estimation – Seismic + Well	711

Introduction to SPW

Welcome to Seismic Processing Workshop (SPW). SPW is a seismic processing solution written by Parallel Geoscience Corporation. SPW was originally written for the Macintosh computer platform and has been redesigned and rewritten for the third time (version 3) using the Qt by Nokia cross platform framework. SPW is currently available and has been tested on the Windows 7, Windows Vista, Windows XP, Windows 2003 Server, and Windows 2008 HPC Server operating systems. Linux, and Macintosh OSX versions will be available sometime in 2014.

The SPW version 3 Flowchart has adopted a project model for data management. Flowchart allows you to create or select a project, build processing flows, set the parameters for the processing steps and display seismic data and maps. Another significant change in SPW 3 is the use of SEG Y format as the default native format for processing data. A simple graphical user interface reduces the learning curve and accelerates your analysis and processing time

The SPW system is designed to be user expandable. Parallel Geoscience Corporation will release the programming API interfaces for the SPW Flowchart version 3 to all SPW users in 2014. Since Qt is available with an open source license, this will allow for easily adding customized processing algorithms and data formats to the SPW system.

Product Support

For solutions to questions about SPW, first look in this manual or consult the release notes file accompanying every software release. If you cannot find answers in the documentation, contact Parallel Geoscience Corporation via E-mail (support@parallelgeo.com), or for time critical issues by phone (+1.541.421.3127). The support email account is monitored daily by several people. It is the best way to get a response, since it is checked even when no one is in the office. Please be ready to provide the following information:

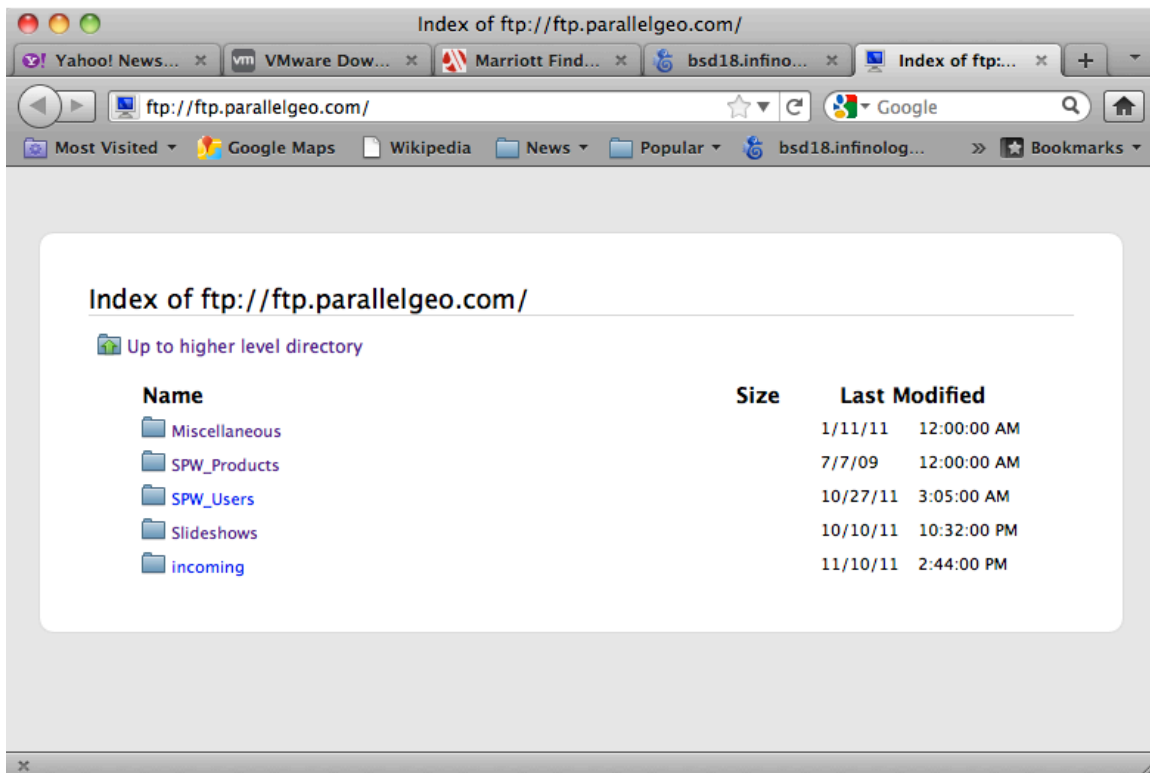
- Your name.
- Your company name.
- The SPW version you are using.
- The operating system you are using.
- The type of hardware you are using.
- What you were doing when the problem occurred.
- The exact wording of any error messages appearing on your screen.
- Any other pertinent data set information.

SPW Flowchart Version 3

SPW 3 Installer Available Online

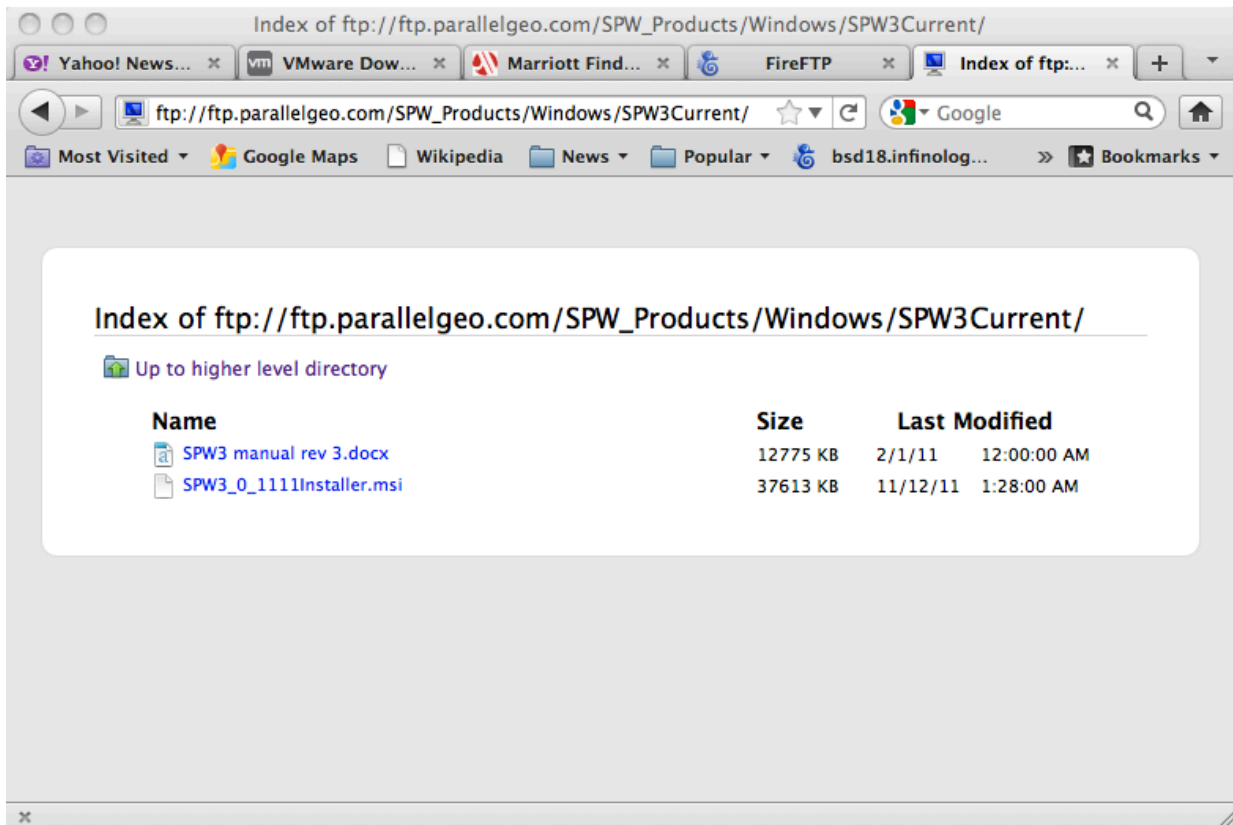
The SPW 3 installer package (.msi) is available on the Parallel Geoscience ftp site. The ftp site is anonymous access so there is no need for a user name and password. To access the ftp site, point your ftp client or your web browser at :

<ftp://ftp.parallelgeo.com>



[ftp.parallelgeo.com](ftp://ftp.parallelgeo.com) Directory listing

Select the SPW_Products directory then select the Windows directory and finally select the SPW3Current directory. You will see a directory listing as shown below.

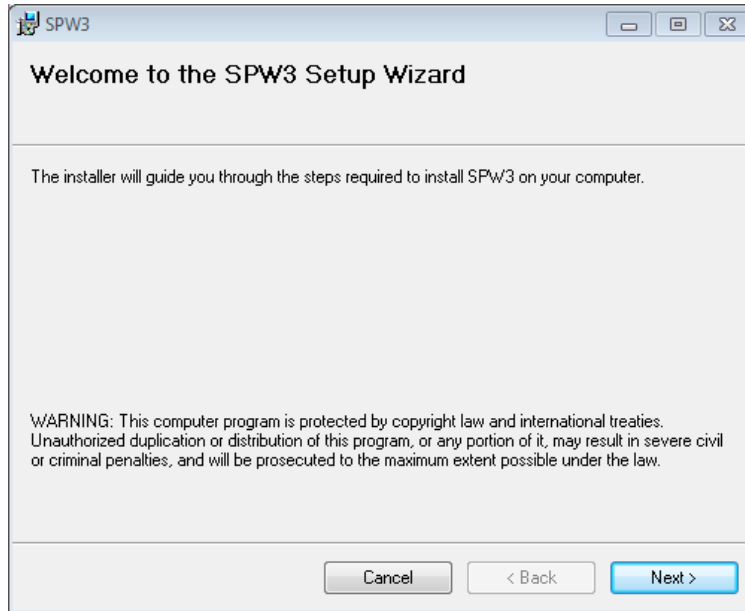


SPW 3 Current Release Directory

Finally, download and save the SPW3 msi file and the documentation to your computer.

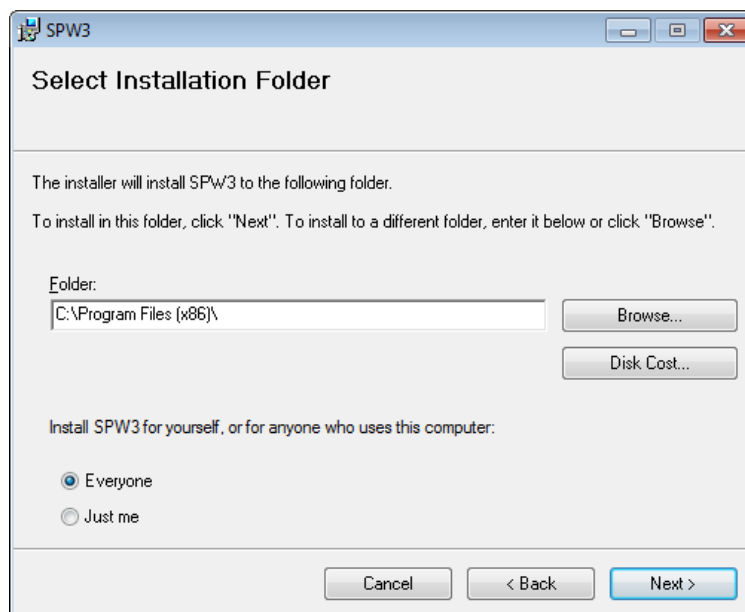
Installing SPW 3 on Windows

Run the SPW 3 installer package (.msi) that has been downloaded from our ftp site or delivered on CD-ROM or DVD-ROM. Please note that you must uninstall any previous version of SPW 3 before you can install a new version. Do so using the Windows control panel for applications.



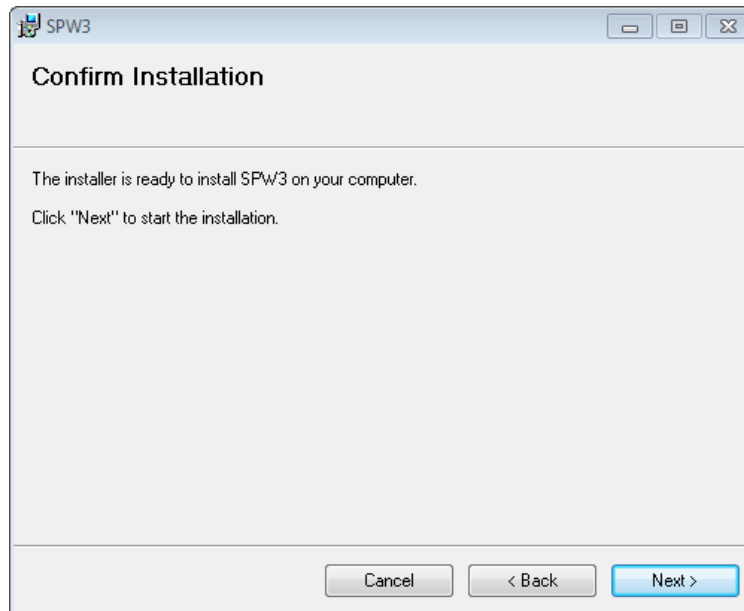
SPW 3 Installer First Dialog

Click on the Next button then you will be prompted to select the installation directory.



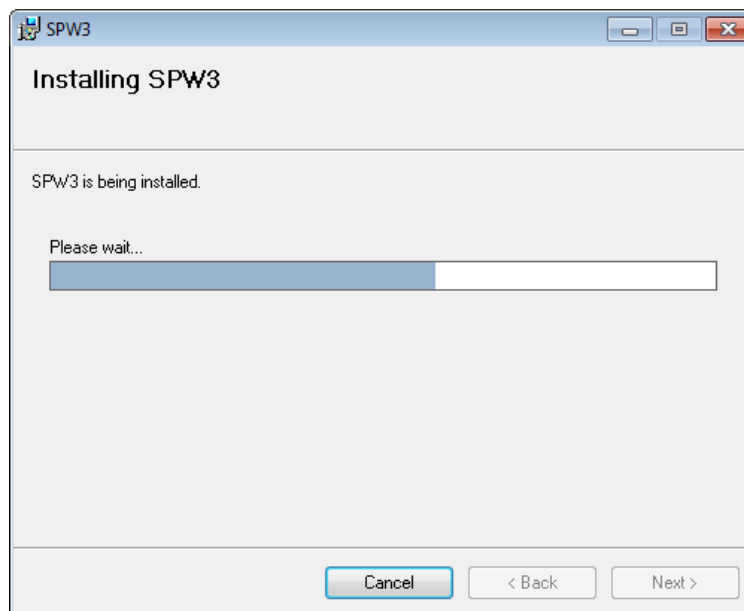
SPW 3 Installation Directory

Click on the Next button then you will be prompted to confirm the installation.



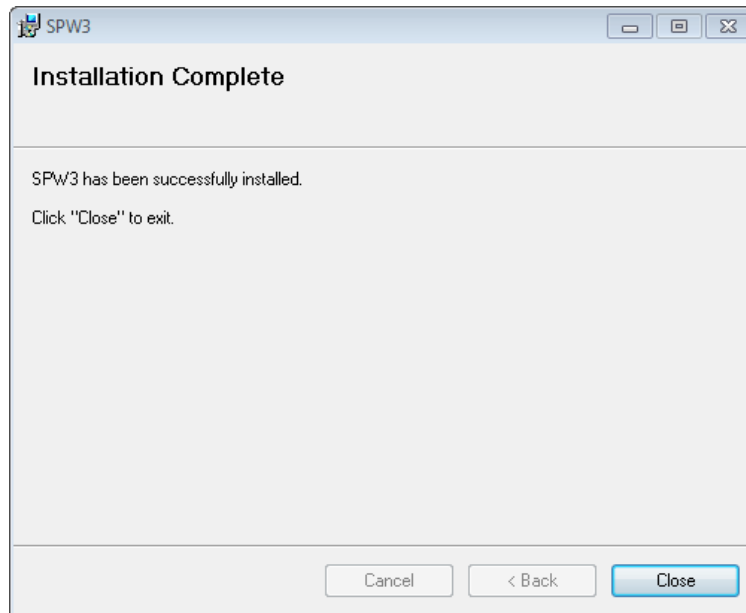
SPW 3 Installation Confirmation

Click on the Next button then the installation will be performed and you will shown the status of the installation.



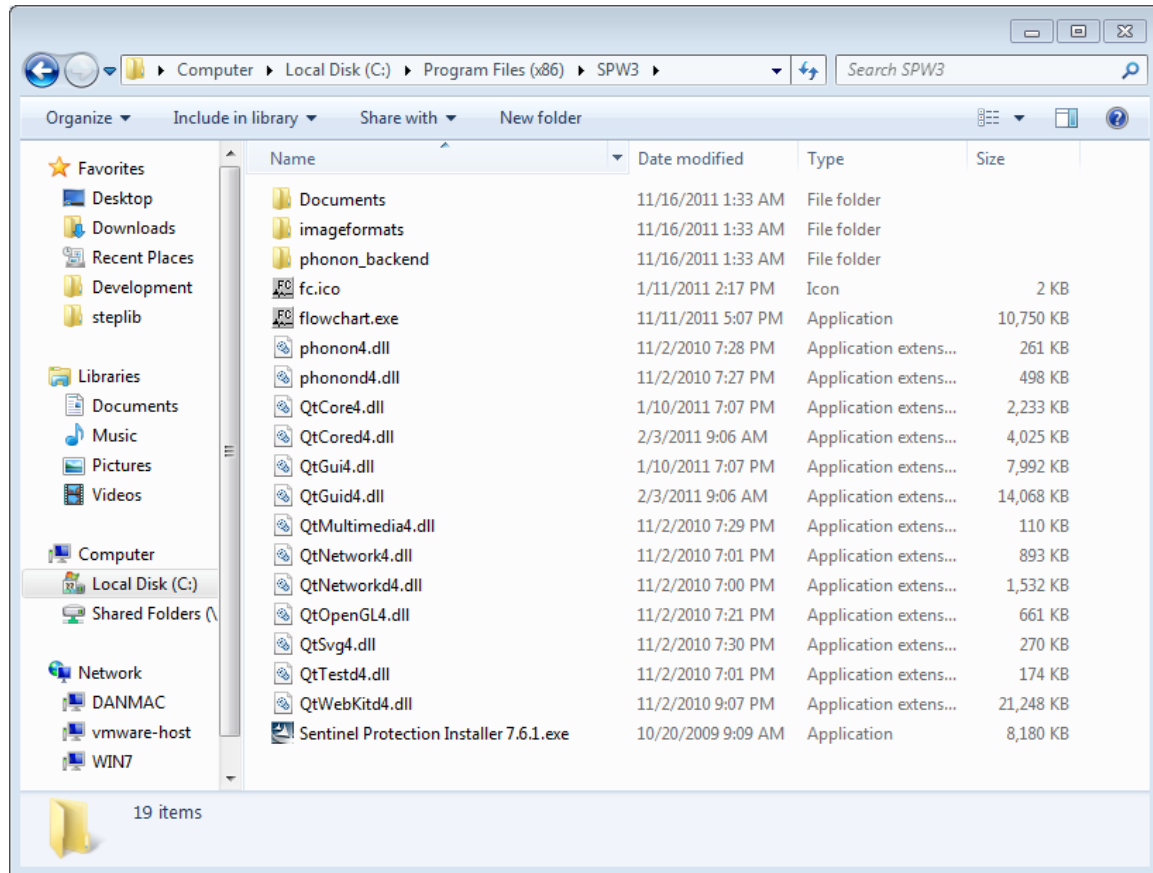
SPW 3 Installation Status

Finally, the Installation Complete message will be shown. Now SPW 3 is ready for use.



SPW 3 Installation Complete

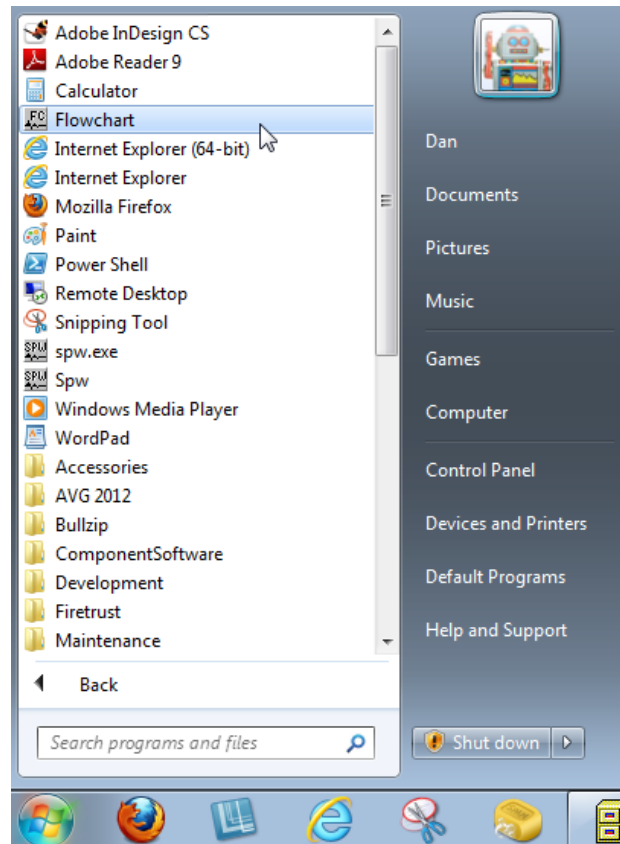
When the installation has finished, your SPW3 directory will be populated with the files and dll libraries required for running SPW 3.



SPW 3 Install Directory

If you do not have the Sentinel software driver installed on your system, please install it by running the Sentinel Protection Installer executable (.exe) in the SPW3 directory. This driver is required to recognize and access the Sentinel USB security key used for licensing of SPW 3.

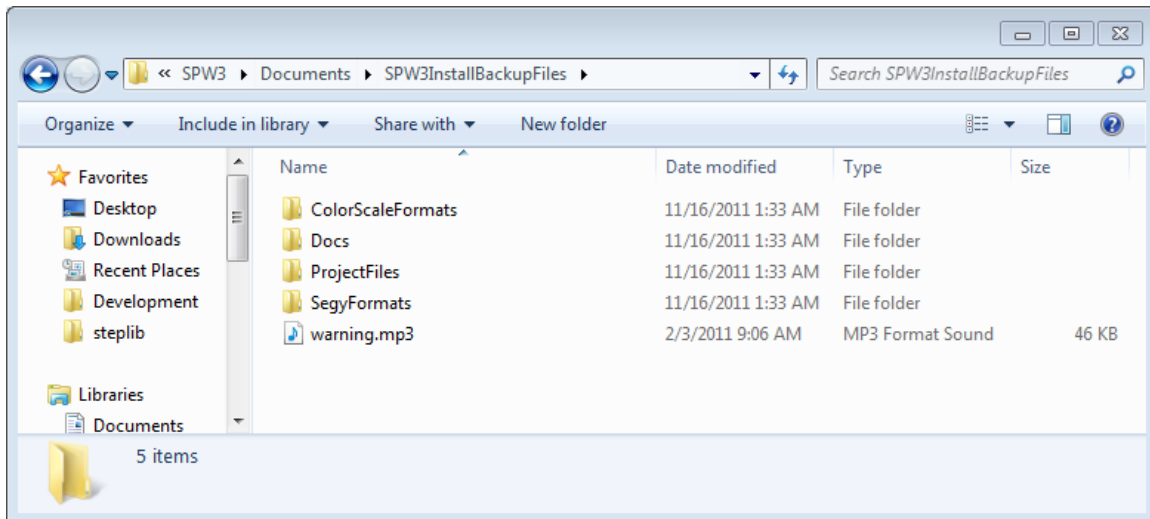
The SPW 3 installation automatically creates a menu item to run Flowchart.exe.



Flowchart Menu Item

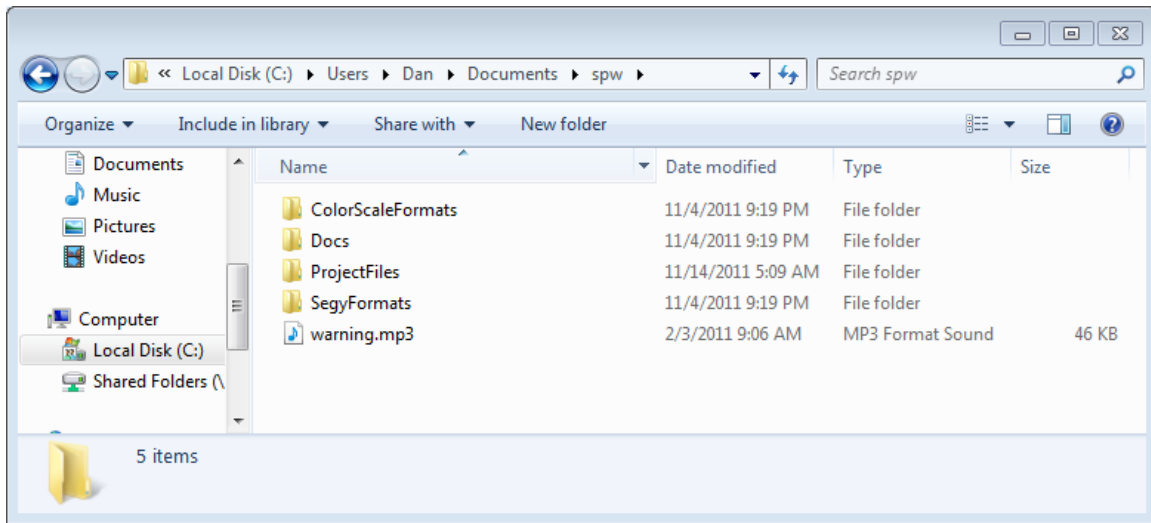
SPW 3 User Directory

The first time the Flowchart application is executed after the installation, a number of directories and files are copied to the documents home directory on Windows. This location is different for each version of Windows and also is different depending on the operating system language. The images shown here are all for Windows 7 US English version.



Files Installed into SPW3 Install Directory

The files written into the .../SPW3/Documents/SPW3InstallBackupFiles are original backup copies of all the color scales, the online documentation, a SPW3 Project directory (more about projects later), default SEG Y format definition files and a mp3 file that is played as a warning in several processing steps inside SPW3. When Flowchart.exe is executed, any of these files and directories that do not already exist in the users home documents directory will be automatically copied to the users home documents directory.

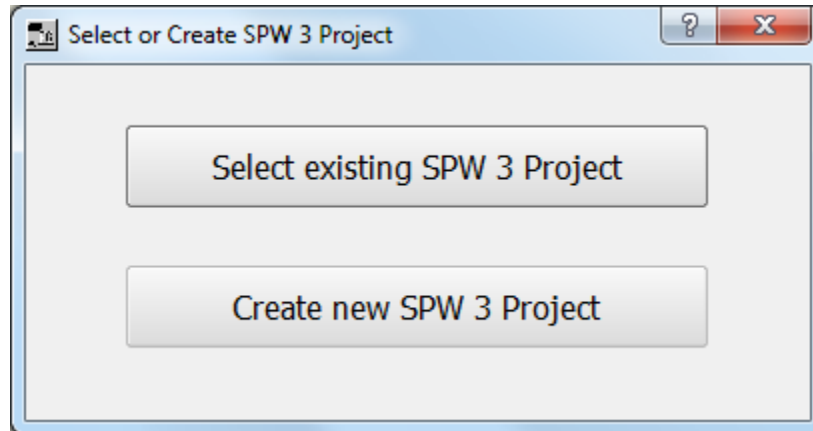


Files in the Users home Documents/spw Directory

If you have previously modified or edited any of the files or projects in a prior SPW 3 installation, these modified files are retained and will not be overwritten during this process.

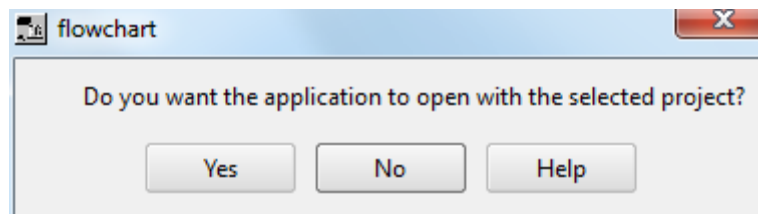
Creating or Selecting a Project

The Flowchart application requires you to either select an existing project or to create a new project when it is first started before you can start building processing flows and analyzing data.



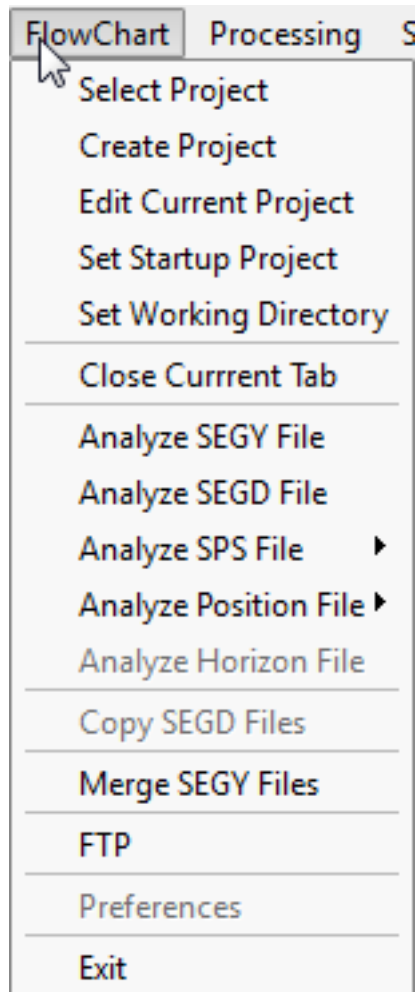
Flowchart Startup

After the first time you run Flowchart, there is usually a default project defined, which is automatically set at startup, and this dialog will not appear. Whenever you select a project or create a new project, you will be prompted, if you wish, to set this project as your default.



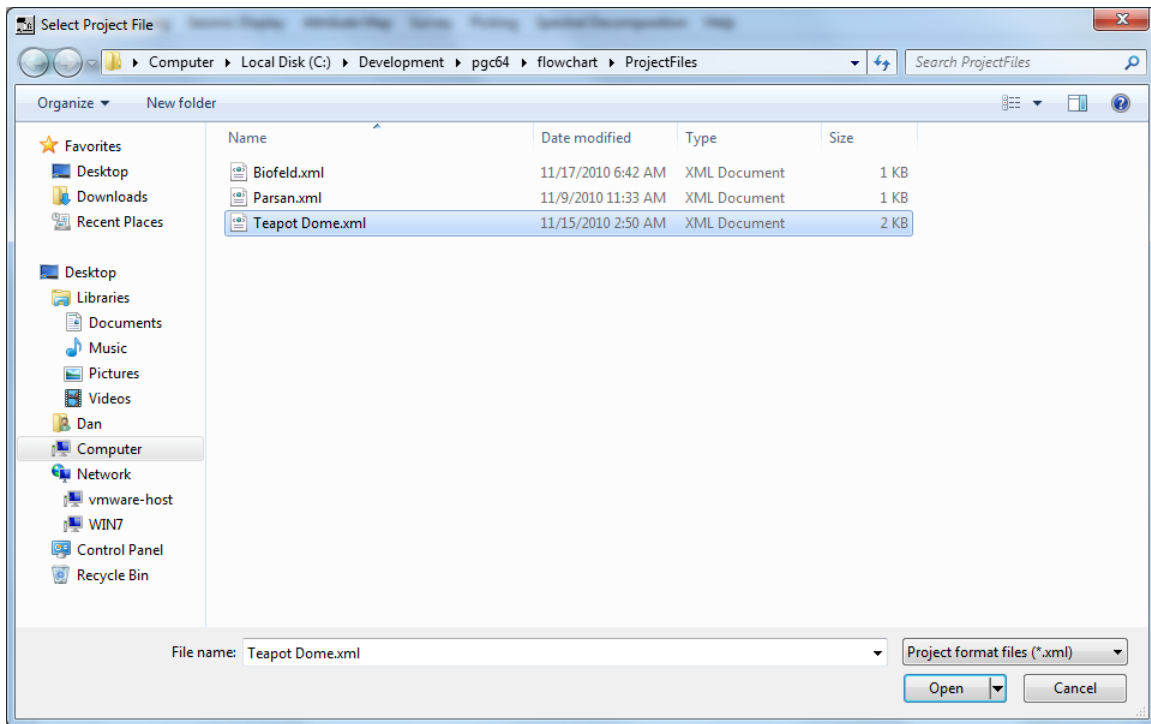
Set As Default

To change the current project or to create a new project, choose either the Select Project or the Create Project command from the FlowChart menu.



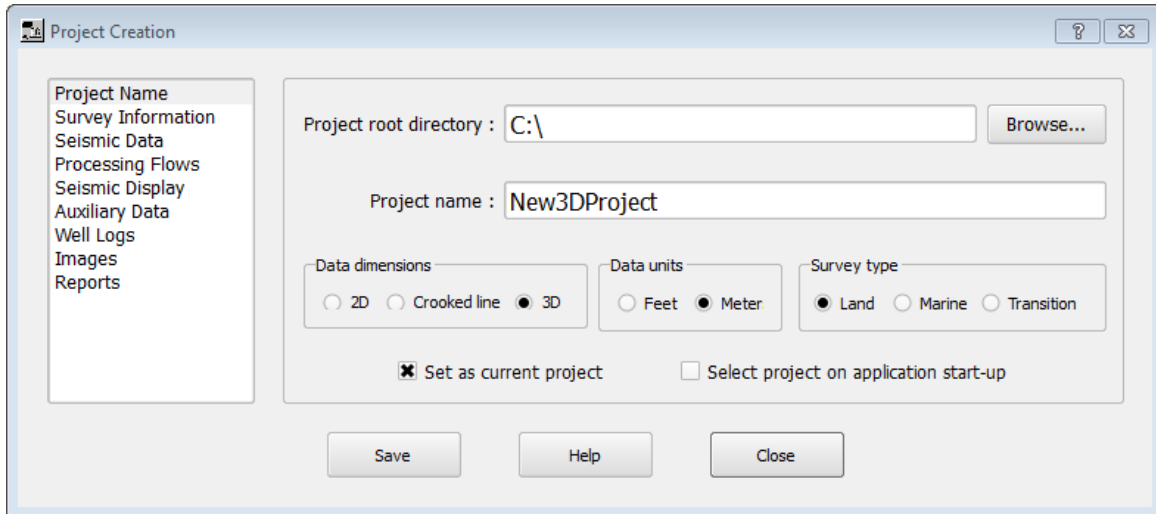
Select and Create Project Menu Commands

When you perform the Select Project command, a list of the project xml files available in your ProjectFiles directory will be shown. Select the project you wish to work on and Open the project.



Select Project XML File

If you are starting in a new area or starting FlowChart for the first time, you will need to choose the Create Project command from the FlowChart menu. When you issue this command, the following dialog will appear. The main project directory (in this case New3DProject), will be created inside the selected project root directory. The project root directory can be any mounted disk on your system including networked disk drives.



The image shows a 'Project Creation' dialog box with a light blue title bar and standard Windows window controls. On the left is a vertical list of project components: Project Name, Survey Information, Seismic Data, Processing Flows, Seismic Display, Auxiliary Data, Well Logs, Images, and Reports. The main area contains several input fields and options. The 'Project root directory' is set to 'C:\' with a 'Browse...' button. The 'Project name' is 'New3DProject'. There are three groups of radio buttons: 'Data dimensions' with options 2D, Crooked line, and 3D (selected); 'Data units' with options Feet and Meter (selected); and 'Survey type' with options Land (selected), Marine, and Transition. At the bottom, there are two checkboxes: 'Set as current project' (checked) and 'Select project on application start-up' (unchecked). Three buttons at the bottom are labeled 'Save', 'Help', and 'Close'.

Project Creation

Project Name
Survey Information
Seismic Data
Processing Flows
Seismic Display
Auxiliary Data
Well Logs
Images
Reports

Project root directory : C:\ Browse...

Project name : New3DProject

Data dimensions
☐ 2D ☐ Crooked line ☒ 3D

Data units
☐ Feet ☒ Meter

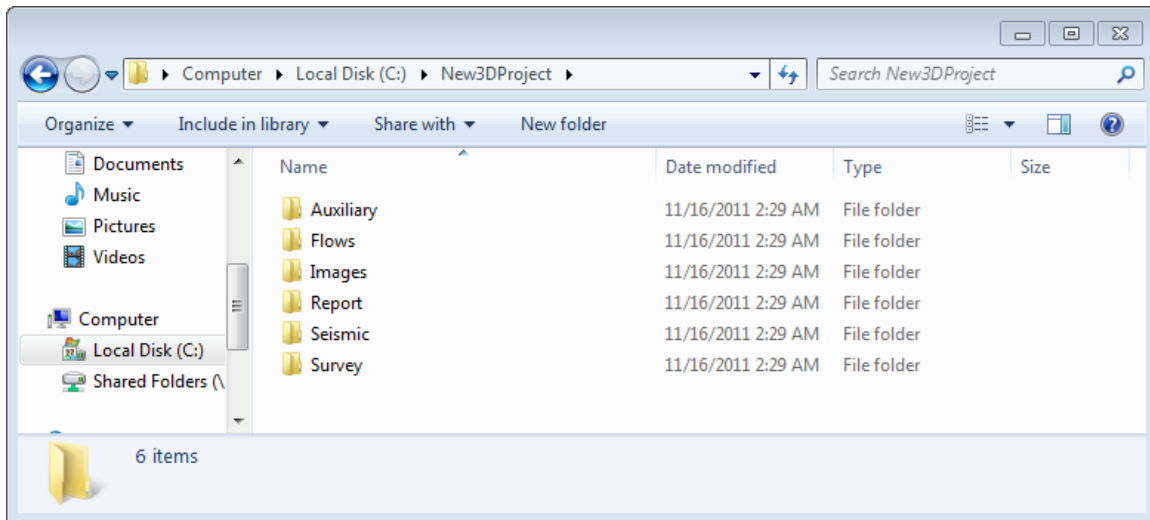
Survey type
☒ Land ☐ Marine ☐ Transition

☒ Set as current project ☐ Select project on application start-up

Save Help Close

Create Project Dialog

The Create Project feature builds the directory structure shown below. All auxiliary files such as velocities and statics are stored in the project Auxiliary directory by default. All the flowcharts are stored in the project Flows directory. Any output image files (jpg, png, bmp, gif) are saved in the Images directory. Reports output by the analysis processing steps will be saved in the project Report directory. The output seismic data files generated during processing are automatically stored in the project Seismic directory. You need to place your SPS or UKOOA files into the Survey directory, so the project can recognize them to be able to generate basemaps. Usually, the SPS files have extensions of .sps for Source Survey files, an extension of .rps for Receiver Survey files and an extension of .xps for the Cross-reference (observers' notes) files.



Project Directory Structure

The Edit Project command allows you to easily move projects. As an example, if you have built a project on a portable disk and then mount the disk again but it is a different drive letter, you can edit the project settings and define the new project root directory. All references to files in the project directories are relative to the root directory path.

Project Name
Survey Information
Seismic Data
Processing Flows
Seismic Display
Auxiliary Data
Well Logs
Images
Reports

Project root directory : C: Browse...

Project name : Teapot Dome

Data dimensions
☐ 2D ☐ Crooked line ☒ 3D

Data units
☒ Feet ☐ Meter

Survey type
☒ Land ☐ Marine ☐ Transition

☒ Set as current project ☒ Select project on application start-up

Save Help Close

Edit Project Dialog

SEG Y Processing Format

SPW 3 uses the SEG Y format as the processing file format. Of course data may be read in from other formats but the internal files used in the processing are SEG Y. SEG Y files may be input directly from recording systems or from other seismic software and SEG Y files written by SPW 3 may be read directly by other software such as interpretation packages which use SEG Y. By default, the SEG Y Standard format file delivered as part of the SPW 3 installation is used for decoding the SEG Y files. You can select any SEG Y format file existing in the SegyFormats or you can build a customized format file to read non-standard SEG Y files.

SEG Y Import

SEG Y File

File Name: File Browse...

☐ Input data is composed of multiple disk files

SEG Y Format

Format Name: C:/Users/Dan/Documents/spw/SegyFormats/SEG Y Standard.xml Format Browse...

SEG Y Analyzer Create New SEG Y Format View Existing SEG Y Format

SEG Y Index

Build SEG Y Index View Trace Headers Trace Header Ranges

General Dataset Properties

Number of records Samples per trace Data Dimension
Traces per record Sample interval ☐ 2D survey
Number of traces Sample format ☒ 3D survey

Input Sort and Selection Options

Reset to Internal Order

	Range limit	Minimum value	Maximum value	Interval	Group
Primary sort key <input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Secondary sort key <input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Tertiary sort key <input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Quaternary sort key <input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Create record at Regather groups into supergathers ☐

OK Help Cancel

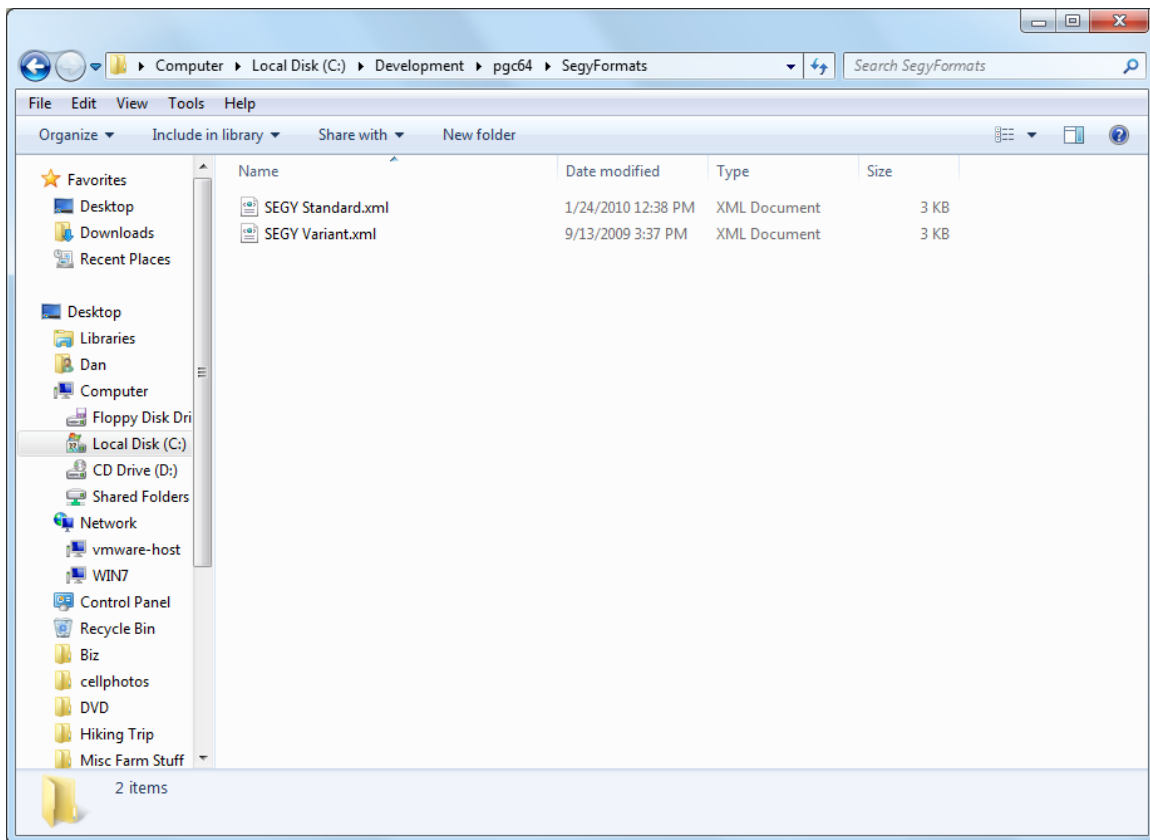
SEG Y Index Fields

- ☒ Trace sequential number
- ☒ Field File Number
- ☒ Channel Number
- ☐ Source Line Number
- ☐ Source Location Number
- ☐ Receiver Line Number
- ☐ Receiver Location Number
- ☐ CMP Location
- ☐ Inline Number
- ☐ Crossline Number
- ☐ Offset
- ☐ Azimuth
- ☐ Frequency
- ☒ Trace Type
- ☐ CMP Easting
- ☐ CMP Northing
- ☐ CMP Elevation
- ☐ CMP Datum Elevation
- ☐ Source Easting
- ☐ Source Northing
- ☐ Source Elevation
- ☐ Source Depth
- ☐ Source Datum Elevation
- ☐ Source Uphole Time
- ☐ Receiver Easting

SEG Y Import Dialog

An index file is created for each SEG Y file used in SPW 3. These files contain important information used in the processing and are required to be present for processing and displays. If they are not present, they will be created by the processing or you may create them by using the Build Index command in the SEG Y Import parameter dialog. Note that the Sorting keys must be set to valid header fields before you press the Build SEG Y Index button and build the index file.

The SEG Y file format is defined by mappings of the SEG Y binary and trace header positions and these are saved in XML file format. There are several prebuilt SEG Y format definition files which are delivered with SPW 3. You can create new format definitions by modifying these using the Create format file command in the SEG Y Analyzer or using the Create New SEG Y Format command in the SEG Y Import dialog.



SegyFormats Directory

SEG Y Format Viewer

Format name: SEG Y Standard

Format description: the standard

☒ Add to format list ☐ Set as default format

Endian order

☒ Get from data ☐ Big endian ☐ Little endian

Text header

Header size in bytes: 3200

Text format: ☒ EBCDIC ☐ ASCII

Binary header

Header size in bytes: 400

	Start byte	Data type	Override	Value
Samples interval	17	2 byte int	<input type="checkbox"/>	0.0000
Samples per trace	21	2 byte int	<input type="checkbox"/>	0
Sample format	25	2 byte int	<input type="checkbox"/>	IBM Float

Trace header

Header size in bytes: 240

Header name	Start byte	Data type
Field File Number	9	4-byte int
Channel Number	13	4-byte int
CMP	21	4-byte int
Inline	181	4-byte int
Crossline	185	4-byte int
Offset	37	4-byte int

Open Format Save Format

OK Cancel

Create SEG Y Format Dialog

The Seismic File is the internal SPW implementation of SEG Y files. The standard SEG Y format is used for the definition of the headers. More detailed descriptions of the SEG Y Import, SEG Y Export and the SPW Seismic File processing steps may be found in the reference section of the documentation.

Seismic File

Seismic File

File name: **File Browse...**

SEG Y Index

Rebuild SEG Y Index **Customize Index Map** **View Trace Headers** **Trace Header Ranges**

General Dataset Properties

Number of records Samples per trace

Traces per record Sample interval

Number of traces Sample format

Data Dimension

☐ 2D survey

☐ 3D survey

Input Sort and Selection Options

Reset to Internal Order

	Range limit	Minimum value	Maximum value	Interval	Group
Primary sort key <input type="text" value="None"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Secondary sort key <input type="text" value="None"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Tertiary sort key <input type="text" value="None"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Quaternary sort key <input type="text" value="None"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Create record at **Regather groups into supergathers** ☐

Output Options

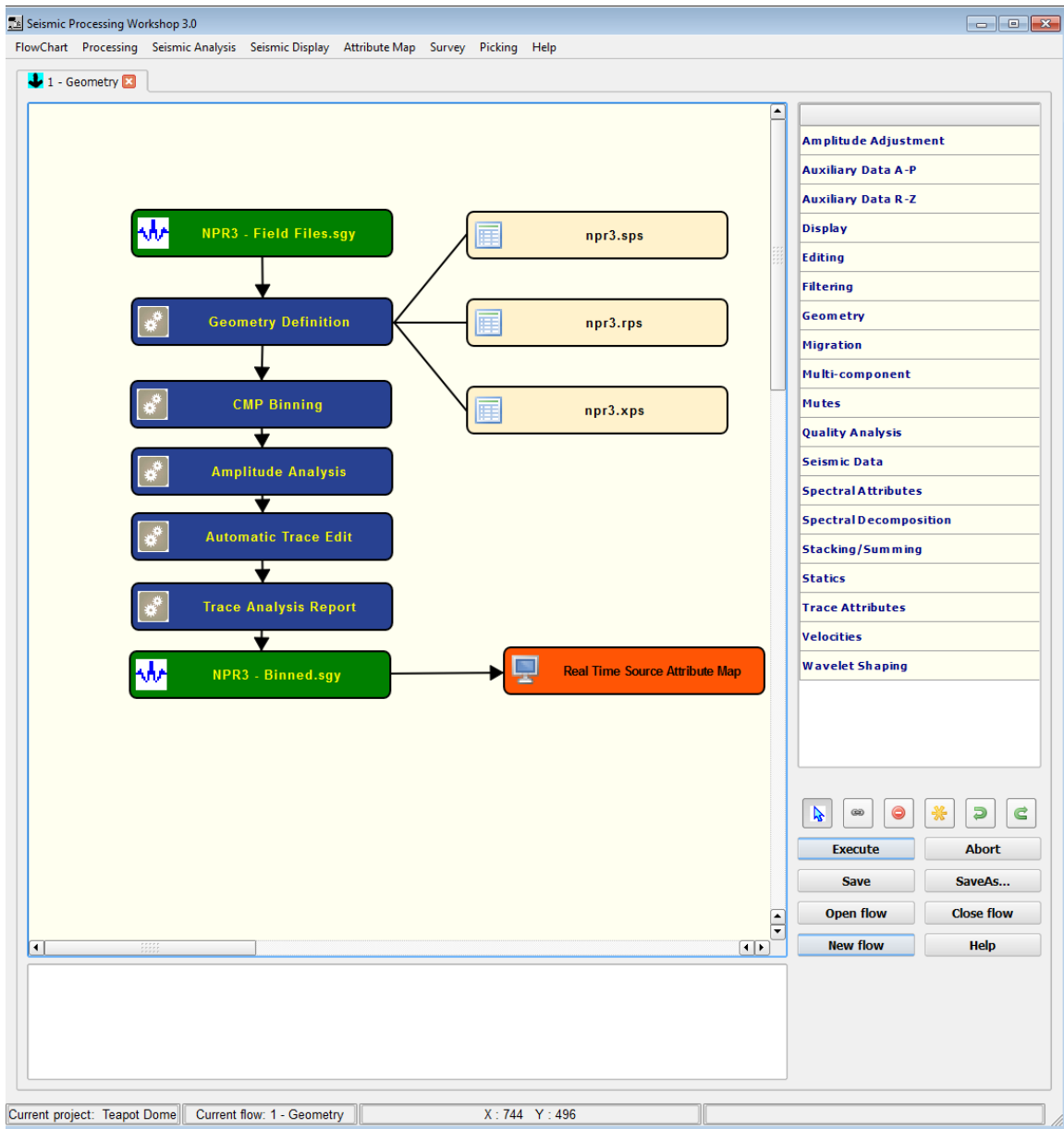
☐ Append to existing dataset ☒ Remove dead traces ☐ Keep dead traces

OK **Cancel** **View Processing History** **Help**

Seismic File Dialog

Main Flowchart Window

The SPW FlowChart application allows you to build processing sequences commonly referred to as flows, set the parameters for processing steps, run the flows you have created, and create displays of maps and seismic data. The FlowChart application is a tabbed interface where multiple processing flows, seismic displays and map displays may be open at the same time. The FlowChart graphical user interface simplifies the process of building a processing flow to a few mouse clicks.



FlowChart User Interface

Tool Bar

The Tool Bar contains a number of tools for controlling the flowchart interface. The function of the tools from left to right are – Select, Link, Delete, Select All, Undo, Redo. Clicking on a tool will change the interface mode, enabling you to use that tool. The tab key allows you to quickly switch between Select and Link. The selection and linking tools are used in building a processing flow and Delete allows for deleting either flow items or flow links from a processing flow.



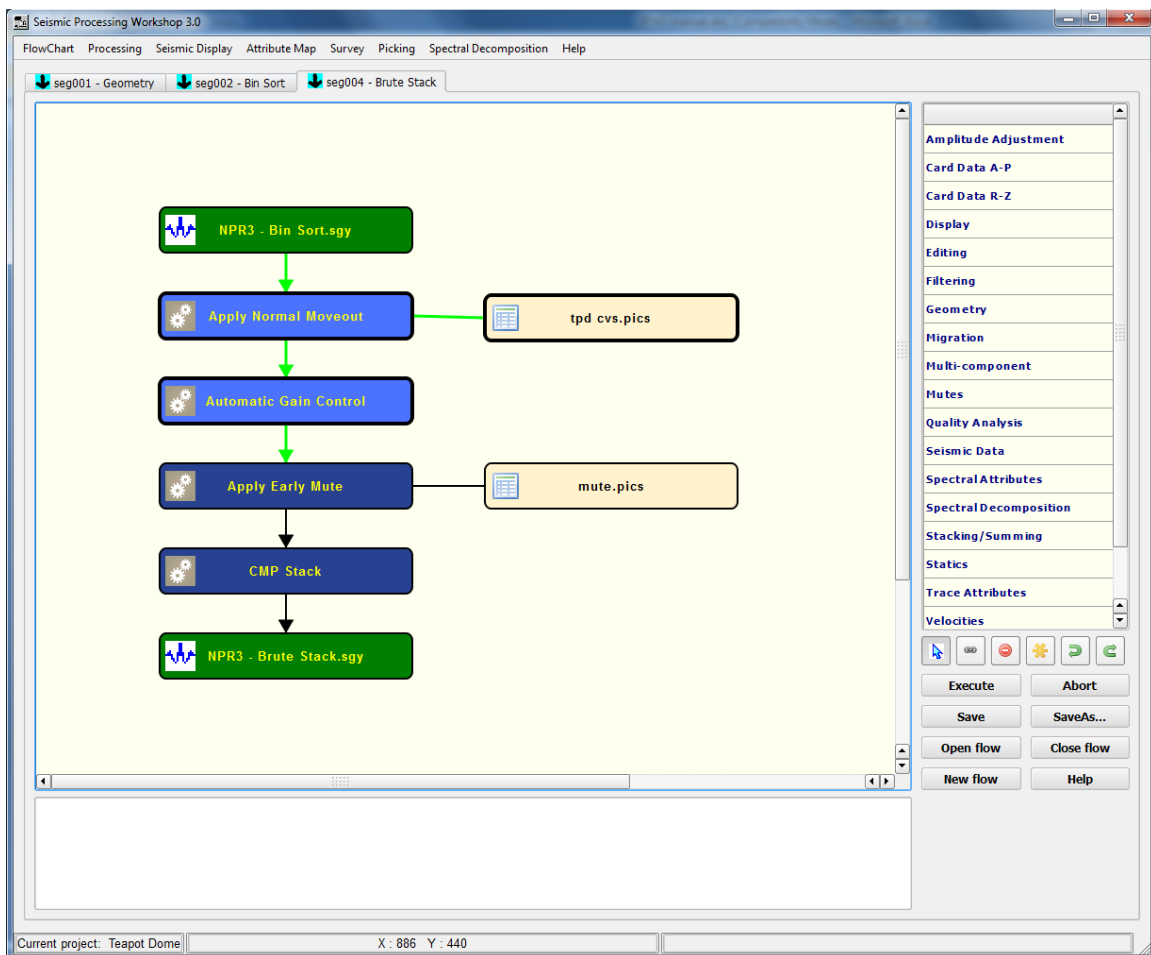
Tool Bar

Selection Tool

The Selection Tool (i.e. the diagonal arrow) can select either a processing step or the link between the processing steps. When selected, the Selection Tool button will appear depressed.



When using the Selection Tool, the items selected will be highlighted; the links will become bright green, and the flow items will be enclosed by a dark black box and shown in light blue, the auxiliary data items will also be enclosed by dark black box. These are illustrated in the flow shown below where the Apply Normal Moveout, Automatic Gain Control and the tpd cvs.pic items and their connecting links are selected.



Selecting Items and Links

Once selected, you can remove an item or a link by either clicking on the Delete Tool on the tool bar or by pressing the delete key on the keyboard. On many Windows keyboards

the backspace key is defined as the Delete. If your Delete key does not work then try the Backspace key instead. Note: all selected items will be deleted.

Linking Tool

The Linking Tool which is the second item in the Tool Bar allows you to define the data flow between items on the flowchart. When selected, the Linking Tool button will appear depressed.



Link Tool

You may switch between the Selection and Linking tools by either clicking on the icons on the Tool Bar or by pressing the Tab key on the keyboard.

Delete Tool

The Delete Tool removes selected items from the flowchart. Once selected, you can remove an item or a link by either clicking on the Delete Tool on the tool bar or by pressing the delete key on the keyboard.



Delete Tool

On many Windows keyboards the backspace key is defined as the delete key. If your delete key does not work then try the backspace key instead. Note: all selected items will be deleted.

Select All Tool

The Select All Tool selects all items on the flowchart.



Select All

When using the Select All Tool, all items will be selected and highlighted; the links will become bright green, and the flow items will be enclosed by a dark black box and shown in light blue, the auxiliary data items will also be enclosed by dark black box.

Undo Tool

The Undo Tool will undo the previous command issued. (**Not yet implemented)



Undo

Use this tool when you have previously performed some function with another tool you wish to reverse.

Redo Tool

The Redo Tool will redo a command previously undone. (**Not yet implemented)

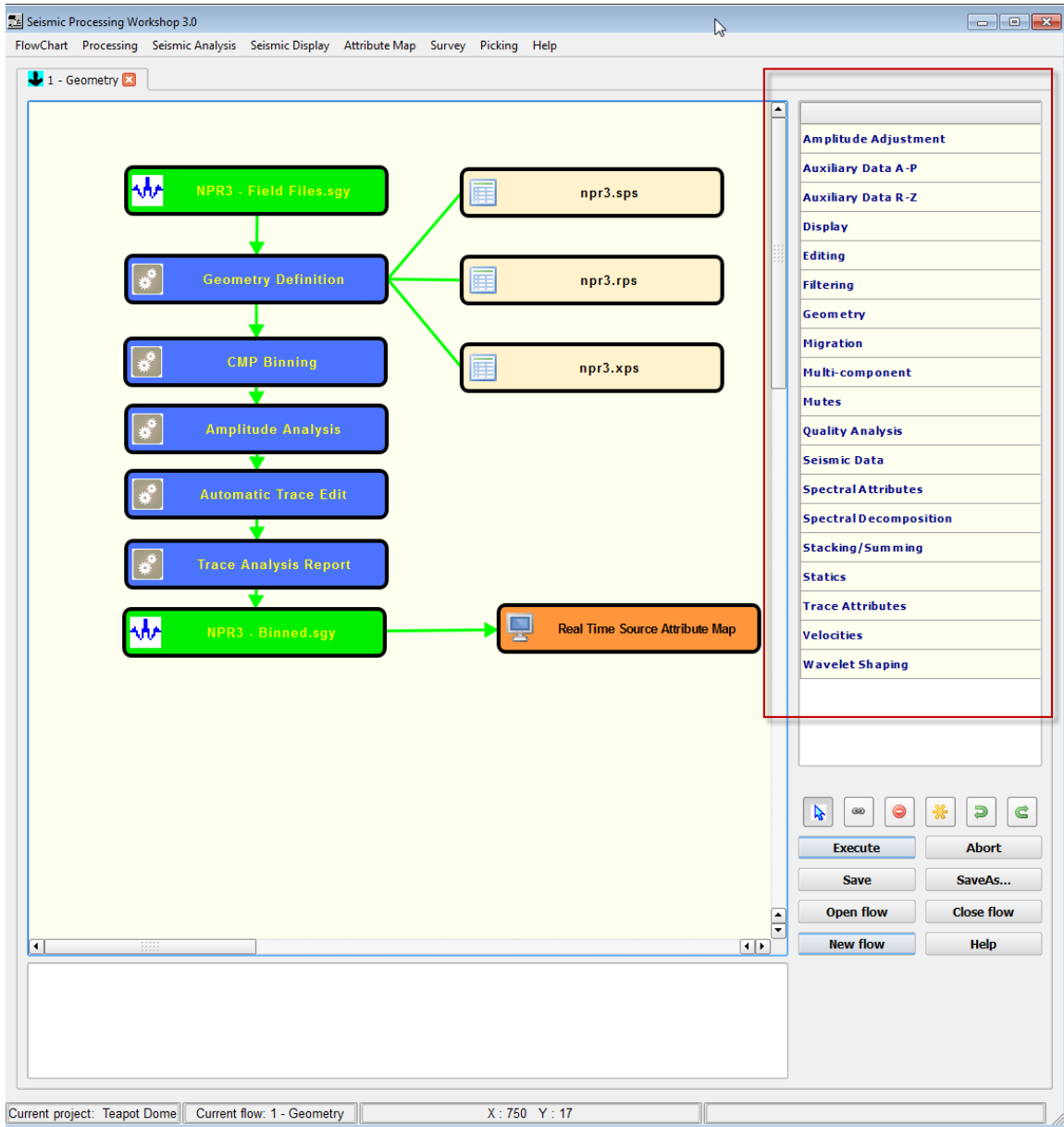


Redo

Use this tool when you have previously undone a function performed by another tool you wish to retain.

Processing Categories

The Processing Categories on the right side of the flowchart window (highlighted by the red rectangle) contains the categories of processing steps available in SPW.

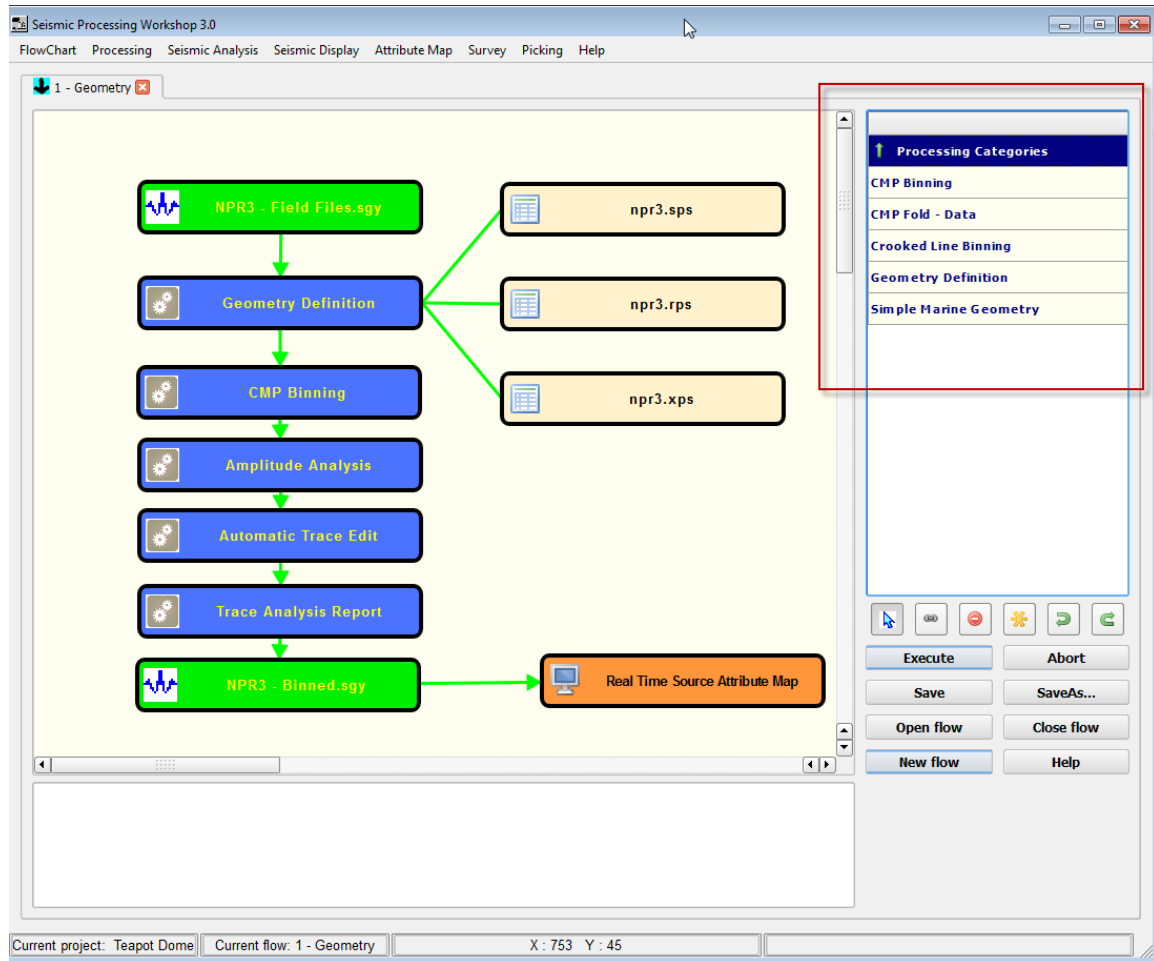


The Processing Categories

When you click on a button in the Processing Categories, such as Geometry, the list of processing steps in that category will appear in place of the Processing Categories list. To navigate back to the Processing Categories list, simply click on the Processing Categories button containing an up arrow at the top of the Processing List.

Processing Steps Lists

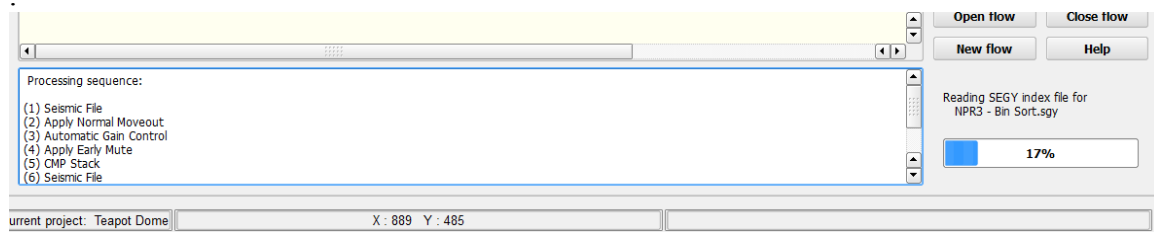
When you click on the desired processing step button, it will appear highlighted in light blue as shown below. To place the item on the flowchart, select it with a single mouse click, and then click on the flowchart where you wish to place the item. You may also double mouse click on the item in the processing step list and it will be placed below the last item you selected on the flowchart. The item may then be dragged on the flowchart to correctly position it into your processing sequence.



Processing Step List

Console Display

The Console Display, at the bottom of the flowchart, shows the messages from the execution of your flows. The first messages will show the list of processing steps being executed, followed by any output warnings and the status as the processing steps are executed. Critical messages may be highlighted in red in the console window.

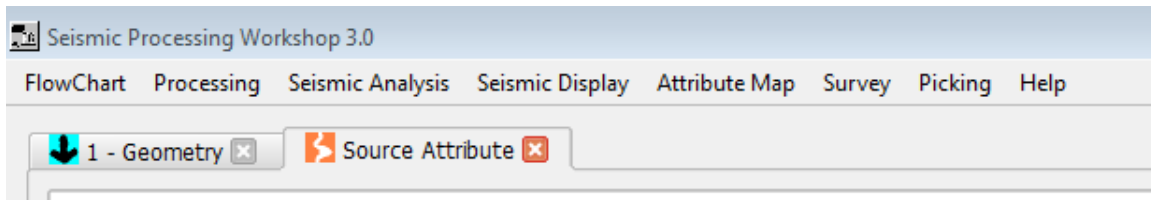


The FlowChart Console Display

Menu Items

The SPW 3 application menu bar contains the following menus:

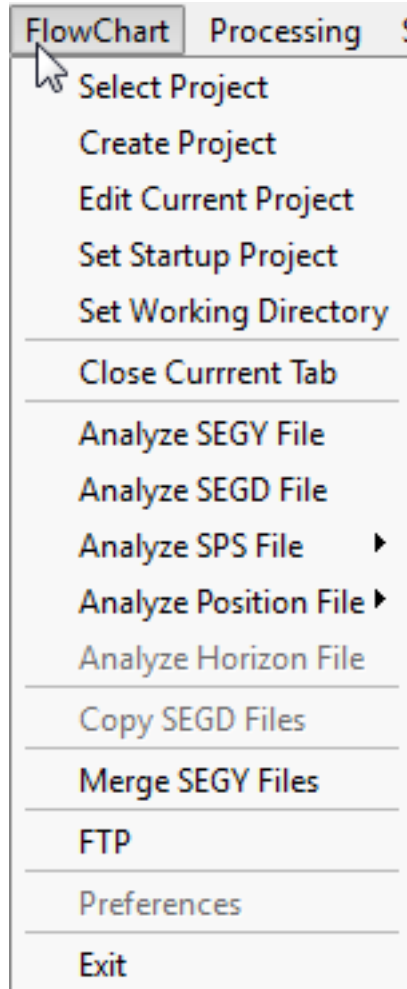
- FlowChart
- Processing
- Seismic Analysis
- Seismic Display
- Attribute Map
- Survey
- Picking
- Help Menu



SPW 3.0 Menu

FlowChart Menu

The FlowChart menu shown below has a number of tools available for project management.



FlowChart Menu

The Select Project and Create Project commands let you select an existing project or create a new project. The Edit Current Project command allows you to edit the currently selected project. The Set startup project defines the default project to be used when the application launches. The Set Working Directory allows you to set the current directory. Close Current Tab will close the active tab in the interface.

SEGY Analyzer

The SEG Y Analyzer allows you to quickly and efficiently open and investigate a SEG Y format file.

The screenshot shows the SEG Y Analyzer application window. It features several configuration panels on the left and a large data view area on the right.

- Endian order:** Radio buttons for "Get from data" (selected), "Big endian", and "Little endian".
- Text header:** A text input field for "Header size in bytes" and radio buttons for "Text format" set to "EBCDIC" (selected) and "ASCII".
- Binary header:** A text input field for "Header size in bytes" and a table for defining header fields.
- Trace header:** A table for defining trace header fields.
- Seismic view:** A large area with tabs for "1-byte Integers", "2-byte Integers", "4-byte Integers", "IBM Floating Point", and "IEEE Floating Point". Below this is a "Trace scan range" from 1 to 11.

Header name	Start byte	Data type	Minimum	Maximum
Field File Number				
Channel Number				
CMP				
Inline				
Crossline				
Offset				
CMP Easting				
CMP Northing				
CMP Elevation				
CMP Datum				
Source Line				
Source Location				
Source Easting				
Source Northing				
Source Elevation				

Buttons at the bottom: OK, File Browse..., Create format file, Help.

SEGY Analyzer

After you use the File Browse to select a file, then the Analyzer entries are populated with the information retrieved from the dataset.

SEG Y Analyzer - NPR3 - Geometry.sgy

Endian order
☒ Get from data
☐ Big endian
☐ Little endian

Text header
Header size in bytes: 3200
Text format: ☒ EBCDIC ☐ ASCII

Binary header
Header size in bytes: 400
Start byte: Data type: Override: Value:

Samples per trace: 21 4-byte int ☐ 1000
Sample interval: 17 4-byte int ☐ 2.0
Sample format: 25 4-byte int ☐ 4-byte IEEE Flo.
Number of traces: ☐ 116887

Trace header
Header size in bytes: 240
Header name Start byte Data type Minimum Maximum

Header name	Start byte	Data type	Minimum	Maximum
Field File Number	9	4-byte int	14	14
Channel Number	13	4-byte int	2	25
CMP	21	4-byte int	2036	2059
Inline	181	4-byte int	790156	792686
Crossline	185	4-byte int	972668	972728
Offset	37	4-byte int	-8663	7943
CMP Easting	193	4-byte int	2036	2059
CMP Northing	185	4-byte int	972668	972728
CMP Elevation	177	4-byte int	5004	5034
CMP Datum	229	4-byte int		
Source Line	197	4-byte int	6023	6023
Source Location	17	4-byte int	6173	6173
Source Easting	73	4-byte int	791919	791919
Source Northing	77	4-byte int	976625	976625
Source Elevation	45	4-byte int	5031	5031

Text header Binary header Trace header Seismic view

1-byte Integers 2-byte Integers 4-byte Integers IBM Floating Point IEEE Floating Point

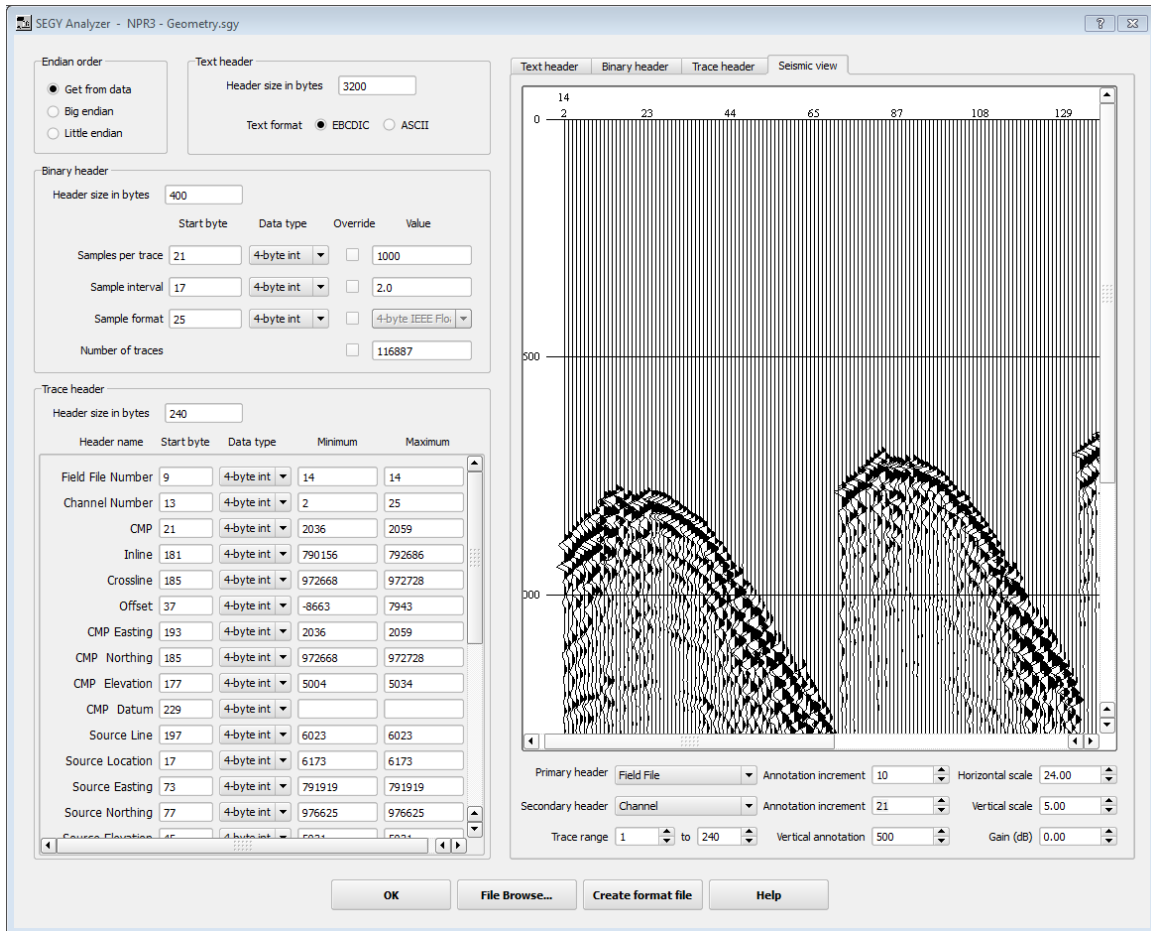
Byte position	Description	Trace 1	Trace 2	Trace 3	Trace 4	Trace 5
1 1 to 4		1	2	3	4	5
2 5 to 8		0	0	0	0	0
3 9 to 12	Field File	14	14	14	14	14
4 13 to 16	Channel	2	3	4	5	6
5 17 to 20	Source Location	6173	6173	6173	6173	6173
6 21 to 24	CMP Location	2036	2037	2038	2039	2040
7 25 to 28		0	0	0	0	0
8 29 to 32		65536	65536	65536	65536	65536
9 33 to 36		65536	65536	65536	65536	65536
10 37 to 40	Offset	-8663	-8571	-8484	-8401	-8320
11 41 to 44	Receiver Elevation	5031	5028	5025	5022	5021
12 45 to 48	Source Elevation	5031	5031	5031	5031	5031
13 49 to 52	Source Depth	0	0	0	0	0
14 53 to 56	Receiver Datum	0	0	0	0	0
15 57 to 60	Source Datum	0	0	0	0	0
16 61 to 64		0	0	0	0	0
17 65 to 68		0	0	0	0	0
18 69 to 72		0	0	0	0	0
19 73 to 76	Source Easting	791919	791919	791919	791919	791919
20 77 to 80	Source Northing	976625	976625	976625	976625	976625
21 81 to 84	Receiver Easting	788393	788614	788833	789054	789290

Trace scan range: 1 to 24

OK File Browse... Create format file Help

SEG Y Analyzer – Trace Headers tab

Using the tabs in the dialog, you can display the SEG Y text header (also referred to as the EBCDIC header), the binary header, multiple selected trace header or a display of the seismic traces.



SEG Y Analyzer – Seismic View tab

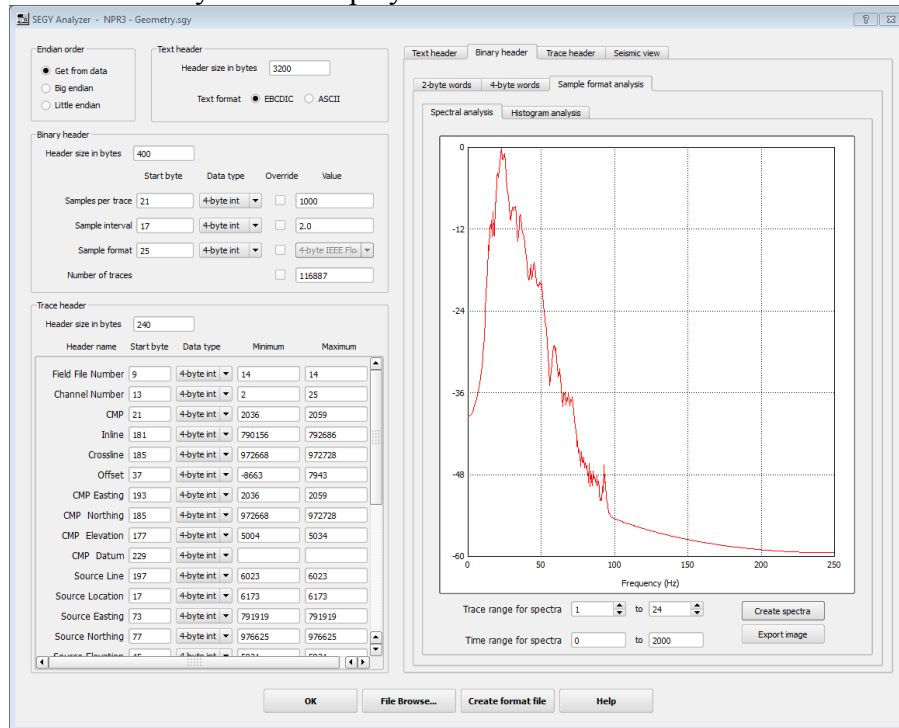
The display of the Binary Header allows you to look at the values as either 2 byte or 4 byte words.

The screenshot shows the 'SEG Y Analyzer - NPR3 - Geometry.sgy' window. The 'Binary header' tab is active, displaying a table of 2-byte and 4-byte words. The table has columns for 'byte position', 'Description', and 'Value'.

byte position	Description	Value
1	1 to 2	0
2	3 to 4	0
3	5 to 6	0
4	7 to 8	0
5	9 to 10	0
6	11 to 12	0
7	13 to 14	0
8	15 to 16	0
9	17 to 18	Sample Interval 2000
10	19 to 20	0
11	21 to 22	Samples per trace 1000
12	23 to 24	0
13	25 to 26	Sample Format 5
14	27 to 28	0
15	29 to 30	0
16	31 to 32	0
17	33 to 34	0
18	35 to 36	0
19	37 to 38	0
20	39 to 40	0
21	41 to 42	0
22	43 to 44	0
23	45 to 46	0

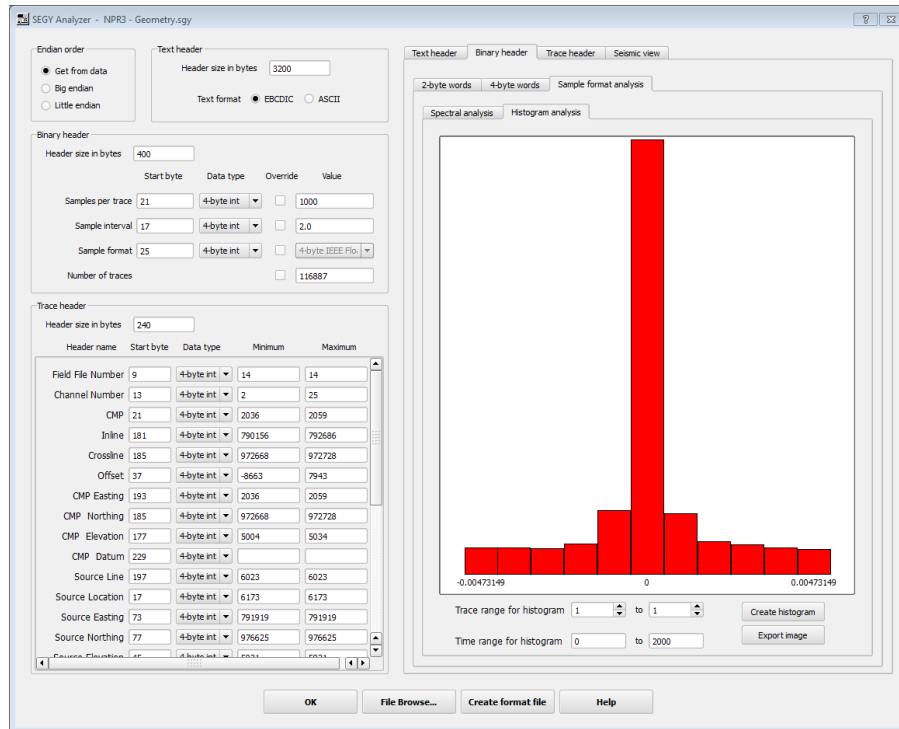
Binary Header Values Display

You also can create a spectra of a selected range of traces in the Sample format analysis tab of the Binary header display.



Spectra Display

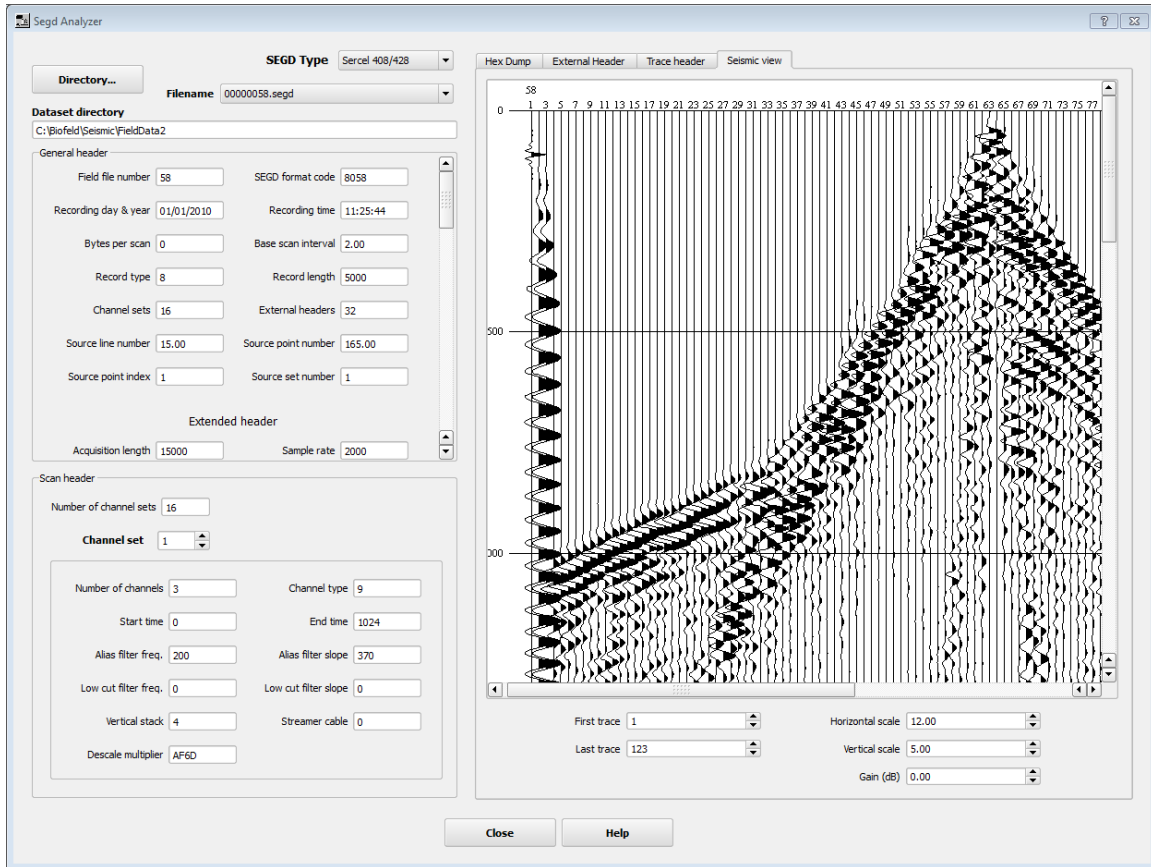
The Histogram analysis tab allows you to see the amplitude distribution of the selected data traces and verify the data has correct and valid amplitudes.



Histogram Analysis Display

SEGD Analysis

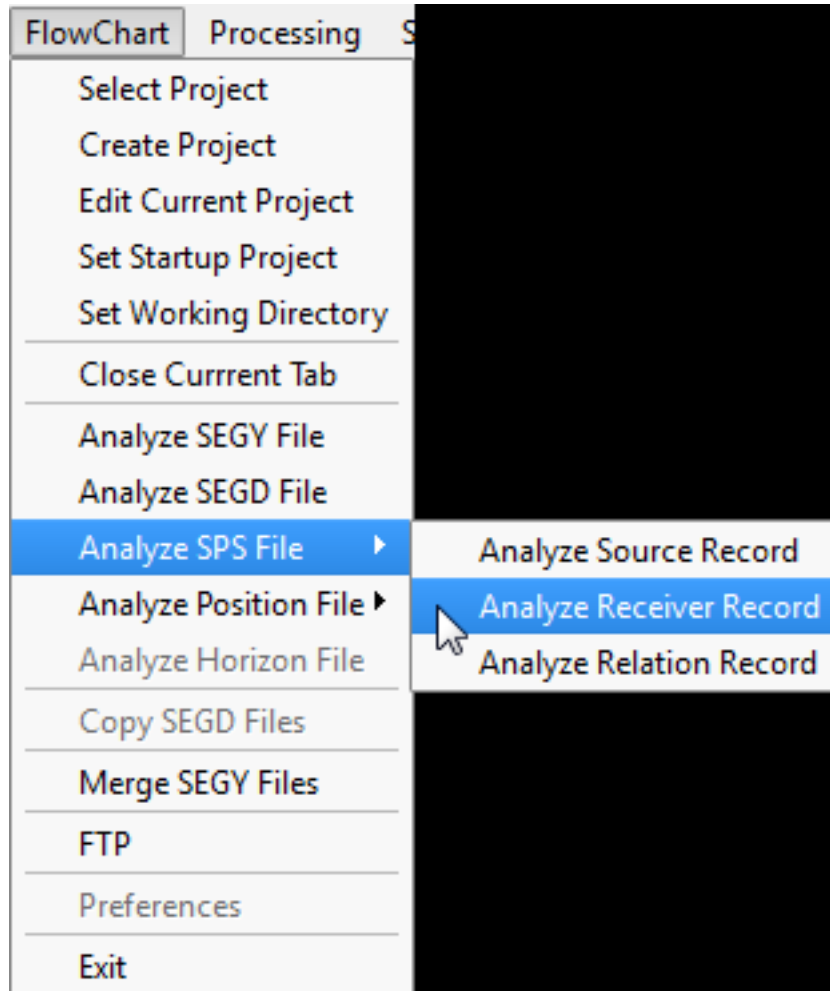
The SEG D Analyzer is very similar to the SEG Y Analyzer and allows you to analyze the various parts of a SEG D file structure.



SEG D Analyzer

SPS Analysis

The SPS Analyzer is allows you to analyze source, receiver and relation sps files and to define the formats of these files.



SPS Analyzer Menu

The SPS Analyzer defines the column positions of the sps format and shows you the definitions of the columns as well as the data value ranges for each column as you edit the format. When finished, Save the format and it is automatically associated with each this specific sps file. Every time this file is read, the format file will be used to decode the data in the file.

Receiver Record identification

Record identification Start Col End Col ☐ Read lines with receiver record ID "R" First line to read

Receiver line	Start Col.	End Col.	Load	Minimum	Maximum	Receiver static	Start Col.	End Col.	Load	Minimum	Maximum
2	17		<input checked="" type="checkbox"/>	2002	2174	29	32		<input type="checkbox"/>	0	0
18	25		<input checked="" type="checkbox"/>	2007	2100	33	36		<input type="checkbox"/>	0.0	0.0
26	26		<input type="checkbox"/>	0	0	37	40		<input type="checkbox"/>	0	0
27	28		<input type="checkbox"/>			41	42		<input type="checkbox"/>	0	0
47	55		<input checked="" type="checkbox"/>	788393.7	809316.5	43	46		<input type="checkbox"/>	0.0	0.0
56	65		<input checked="" type="checkbox"/>	939209.8	976862.8	72	74		<input type="checkbox"/>	0	0
66	71		<input checked="" type="checkbox"/>	4931.2	5656.7	75	80		<input type="checkbox"/>	0	0

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

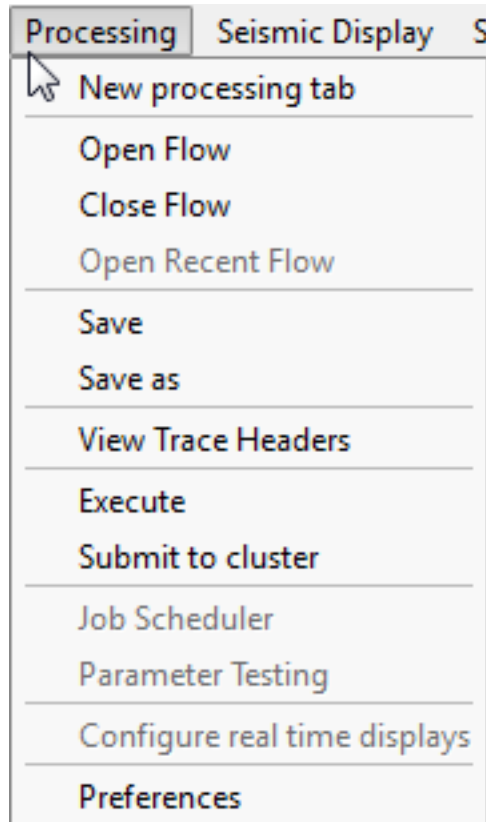
2002 2076 804268.80939377.6005423.5
 2002 2077 804489.00939383.0005379.2
 2002 2078 804710.70939388.8005348.5
 2002 2079 804931.10939393.9005319.6
 2002 2080 805148.90939398.1005322.6
 2002 2081 805369.90939404.1005357.6
 2002 2082 805589.80939408.9005384.1
 2002 2083 805809.00939414.1005404.7
 2002 2084 806029.30939419.5005474.8
 2002 2085 806254.10939209.8005523.2
 2002 2086 806474.50939214.8005525.3
 2002 2087 806695.10939220.1005550.2
 2002 2088 806914.70939225.2005580.5
 2002 2089 807133.60939230.0005589.7
 2002 2090 807354.30939235.9005578.2
 2002 2091 807573.60939240.8005630.3
 2002 2092 807793.60939241.0005656.7
 2002 2093 808014.70939245.1005628.6
 2006 2076 804252.70940028.1005358.8
 2006 2077 804474.50940042.3005344.1
 2006 2078 804694.80940047.4005312.6
 2006 2079 804913.40940052.5005310.5
 2006 2080 805133.90940057.3005339.3
 2006 2081 805354.10940063.3005350.5
 2006 2082 805574.30940068.0005352.6
 2006 2083 805794.50940073.3005358.7
 2006 2084 806011.40940077.2005345.7
 2006 2085 806234.70940082.8005387.1
 2006 2086 806453.20940089.7005400.2
 2006 2087 806673.60940091.0005382.2

Save Format Help Close

SPS Analyzer

Processing Menu

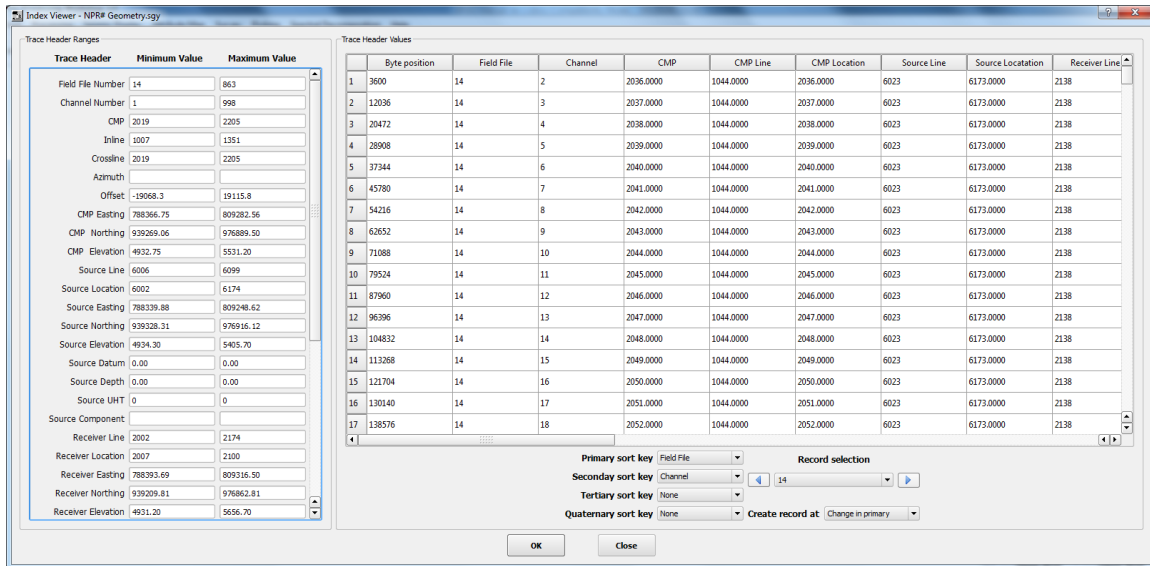
The Processing menu contains the commands for working with the flowcharts.



Processing Menu

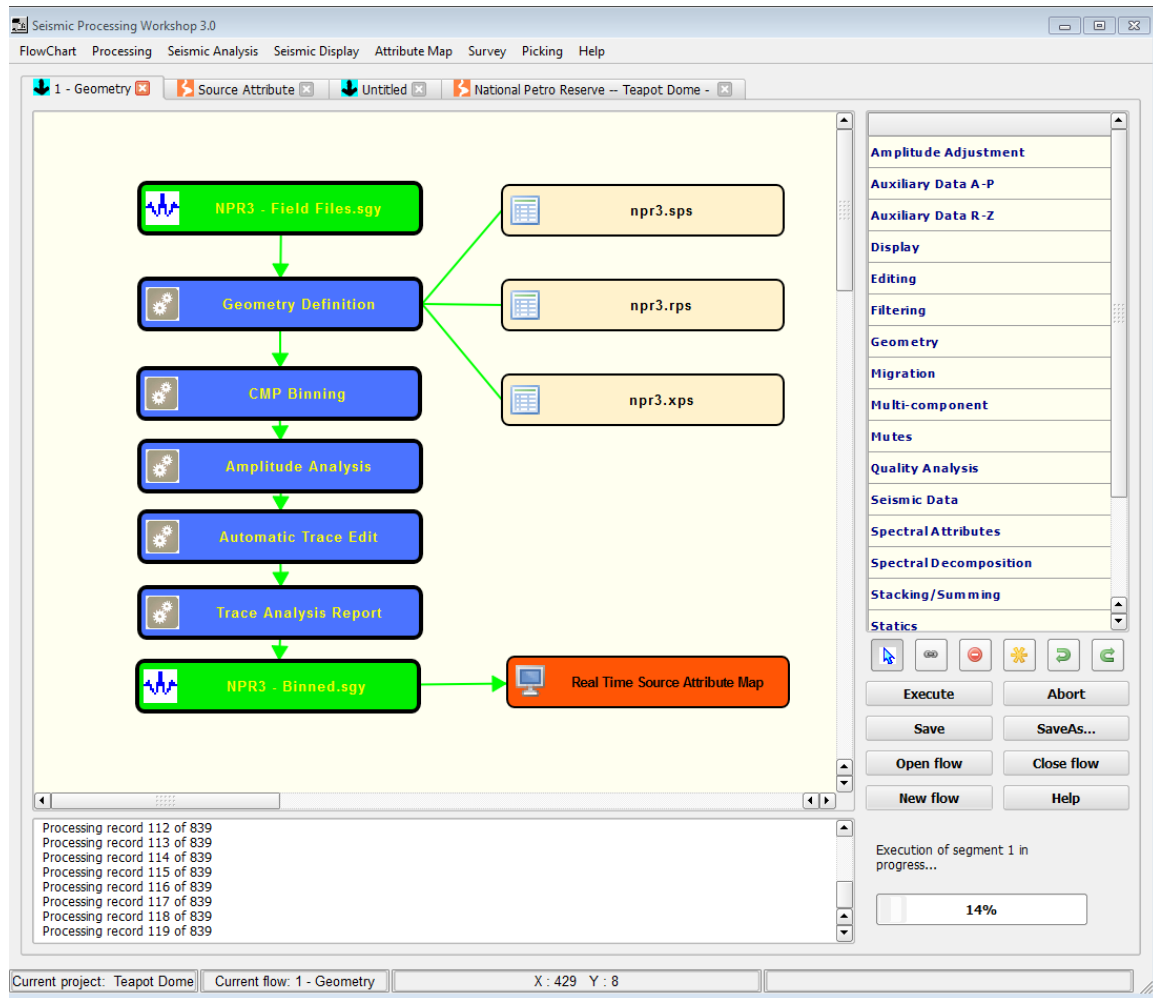
The New processing tab command creates tabbed windows for opening or building flowcharts. The Open flow command will open an existing flow in the current flowchart tab. The Close flow command closes the current flowchart but leaves the tab open. The Open recent flow is not yet implemented. The Save command saves the current flow. If it is an existing file, then it is overwritten. If it has not been named then it issues the Save As command and you are then prompted for a file name.

The View trace headers command opens a spreadsheet view of the trace headers of a selected SEG Y file. If you do not have a SEG Y file currently selected it does nothing



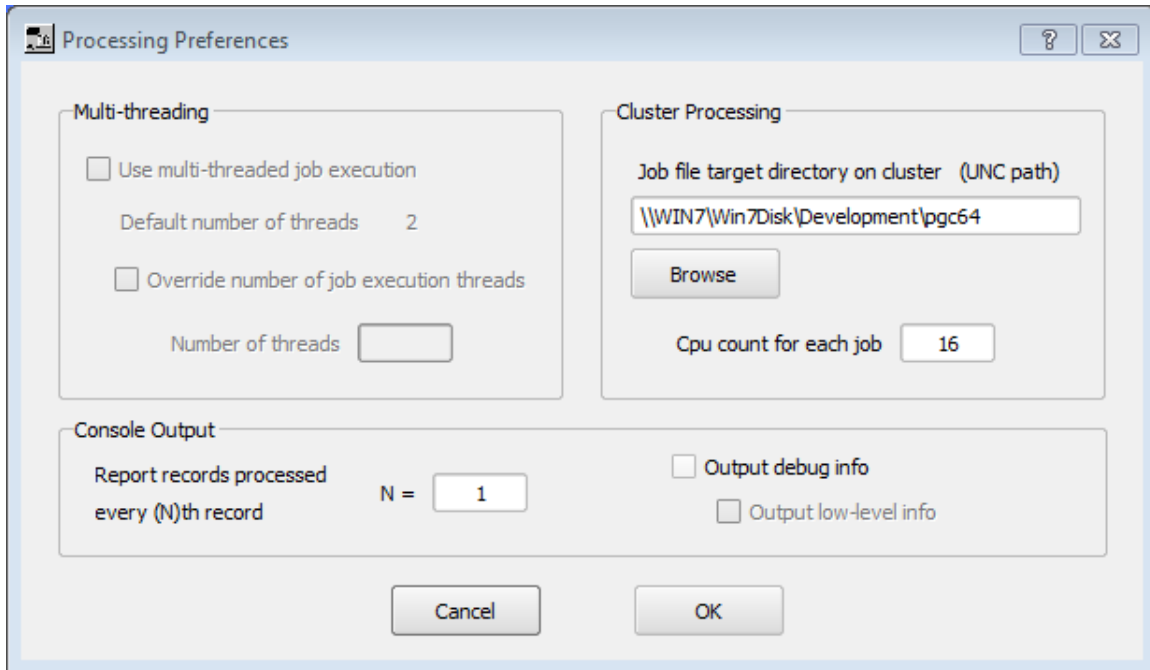
View Trace Headers

The Execute command runs the selected flow. Currently, only one flow segment is allowed in a flowchart. A flow segment is defined as a part of a flow originating with an input seismic disk file and ending in an output seismic disk file. The Submit to cluster command send the job to a remote cluster system. The job Scheduler command, the Parameter Testing command and the Configure real time displays command are currently disabled and are in the process of being implemented.



Executing a flow segment

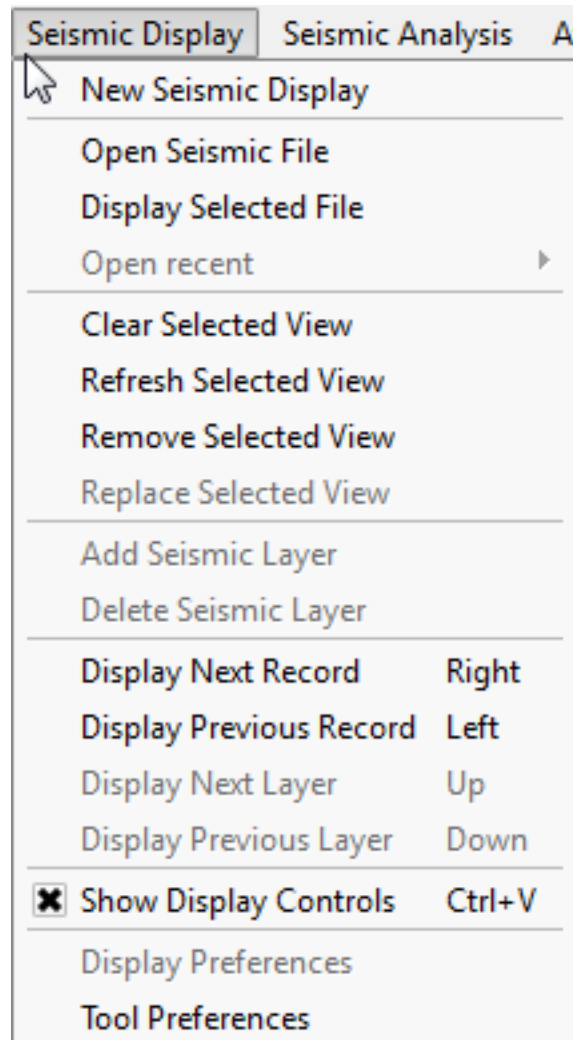
The Preferences command displays the Processing Preferences dialog. This dialog is used to control the threading for local execution and the number of cpus used for remote cluster execution. Also, there are controls on the reporting of processing information into the console.



Processing Preferences Dialog

The Seismic Display Menu

The Display menu contains commands that allow you to display your seismic data and control the display.

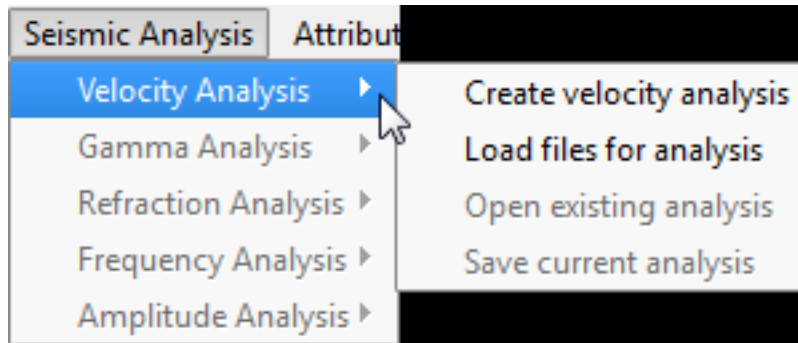


The Seismic Display Menu

The New Seismic Display command, creates a new display tab in the Flowchart Window. The Remove current view command removes the current active display tab from the SPW Window. The Refresh current view command is in development.

Seismic Analysis Menu

The Seismic Analysis menu contains for the analysis tools in SPW 3. The Velocity Analysis tool is the only active analysis tool in the current version. Velocity analysis displays and datasets can automatically be generated using these wizard type commands.



Seismic Analysis Menu

Velocity Analysis Builder

Input seismic file for velocity analysis

File name: **File Browse...**

Analysis outputs

☐ Constant velocity stacks
 ☐ CMP gathers
 ☐ Velocity field
 ☐ Velocity picks
☐ Velocity semblance
 ☐ Stack
 ☐ Hyperbola display
 ☐ Horizons

Velocity pick file

File name: **File Browse...**

☒ Constant Velocity Stacks
 ☐ Velocity Semblance
 ☐ CMP Gathers
 ☐ Additional Output
 ☐ Location Map

Velocity range

First velocity
 Last velocity
 Velocity increment

Line range

First line to analyze
 Last line to analyze
 Line increment
 Lines per analysis

Location range

First location to analyze
 Last location to analyze
 Location increment
 Locations per analysis

Mute Control

☐ Apply mute from data file
☒ Apply stretch mute
 Percentage
 Taper length (samples)

Interpolation Type Selection

☐ Linear
 ☒ Quadratic

Trace Amplitude Definition

☐ Use relative amplitude traces
☒ Use true amplitude traces
☐ Use RMS balanced traces

Stack normalization

Exponent for normalization

Processing

☐ Butterworth Filter
 ☐ Automatic Gain Control

Constant velocity stack file

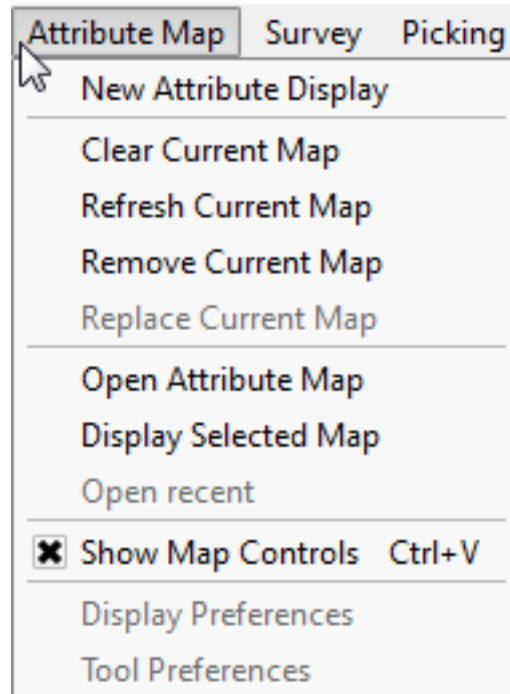
File name: **File Browse...**

Execute and Display
 Execute
 Create Flow File
 Help
 Close

Velocity Analysis Builder (Wizard)

The Attribute Map Menu

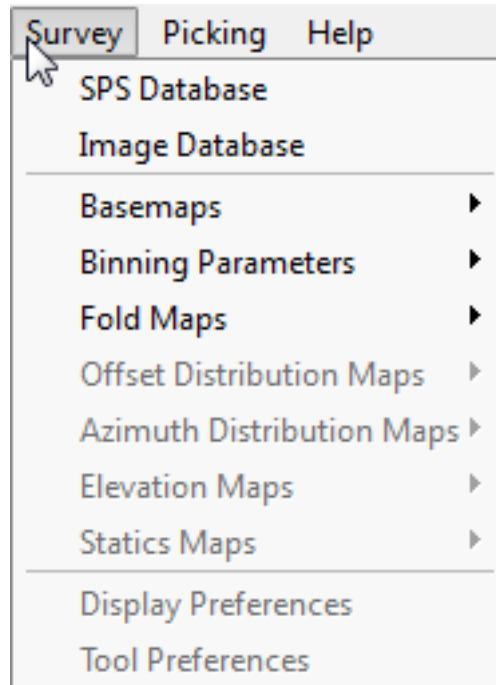
The Attribute Map menu contains commands that allow you to display maps of attributes which are calculated on the seismic data.



The Attribute Map Menu

The Survey Menu

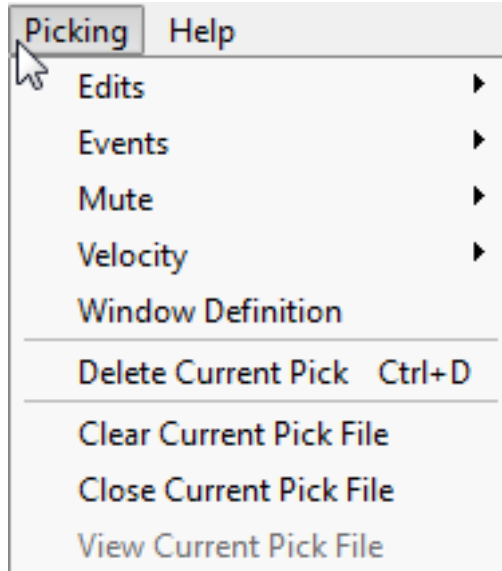
The Survey menu contains commands for displaying maps of the data locations, defining the 3D coordinate binning information and quality checking of the geometry information.



The Survey Menu

The Picking Menu

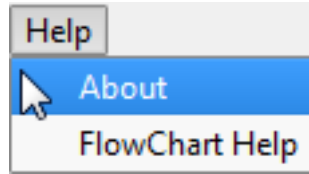
The Picking menu contains commands for picking various auxiliary data including first breaks, horizons, velocities, or mutes.



The Picking Menu

The Help Menu

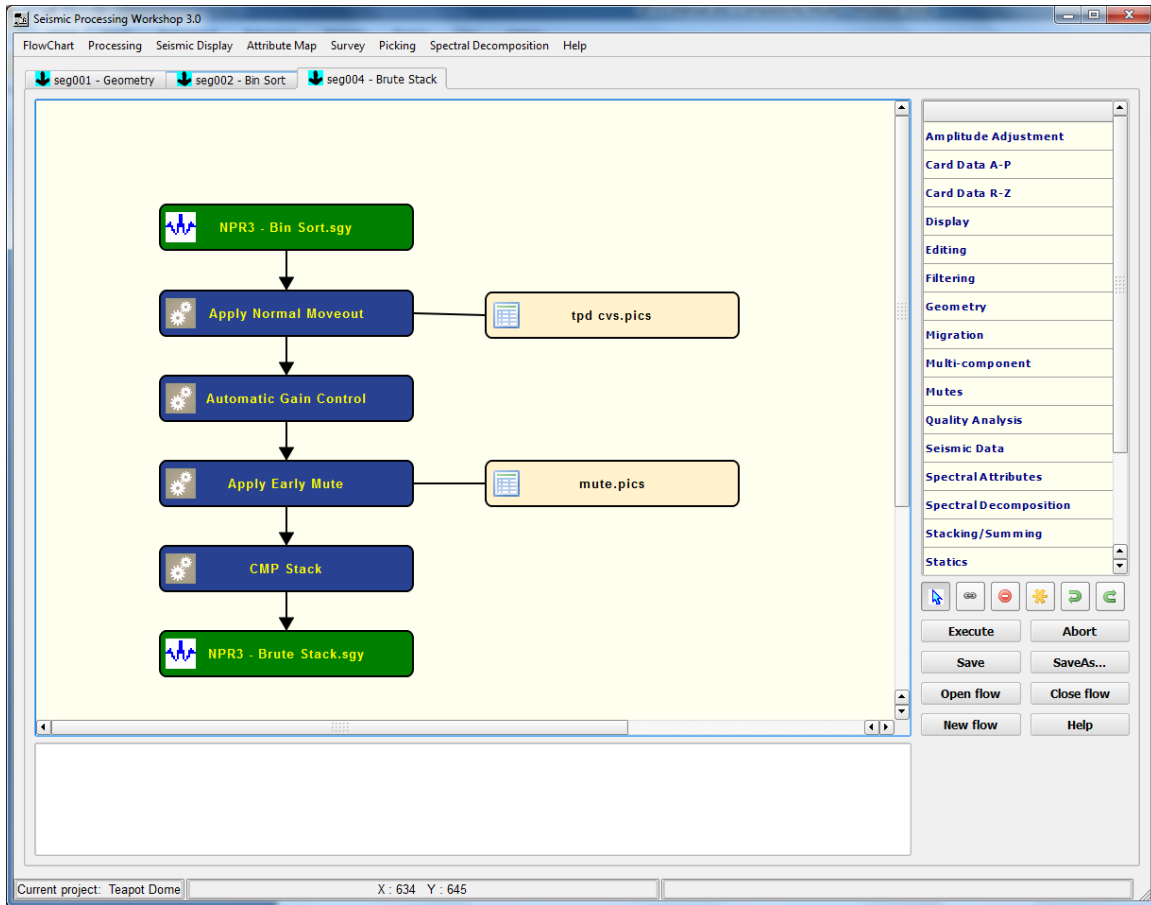
The Help menu contains commands for displaying the current information about the installed version of SPW 3 and the licensing and access to the Flowchart help files.



The Help Menu

Building Processing Flows

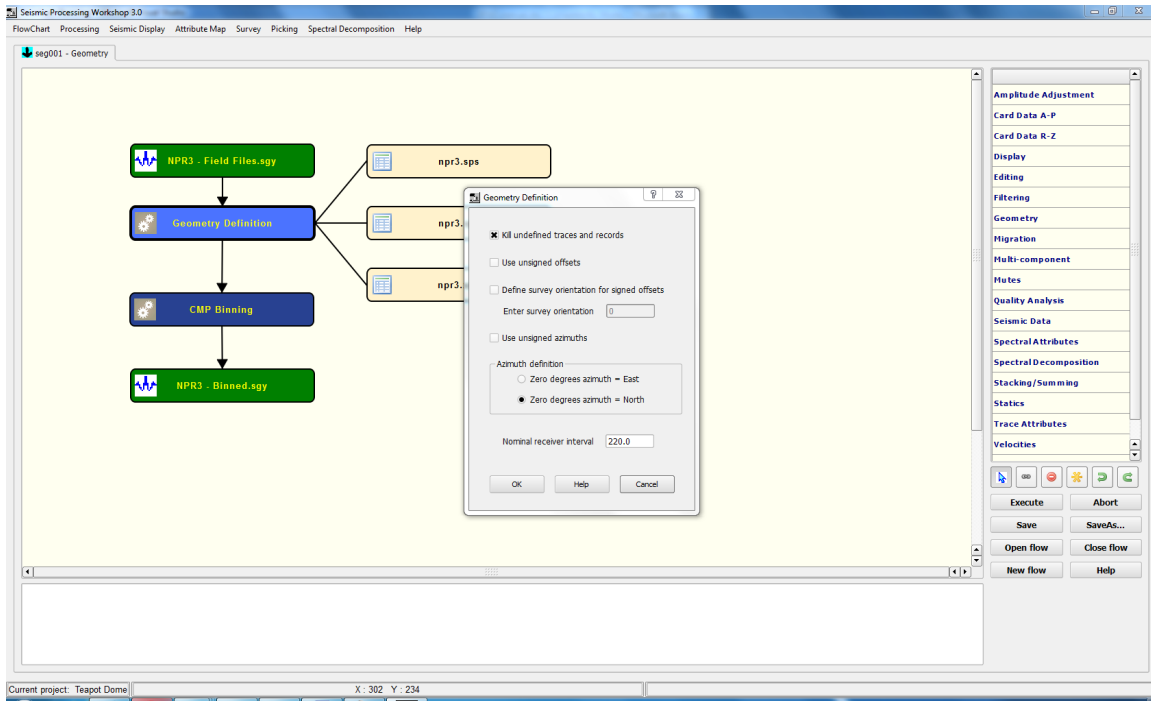
To build a flow, start by selecting the steps you wish to use in the processing step lists and placing them on your flowchart. Next, using the Link Tool, connect each item in the flow as you wish for the data to move through the processing sequence. The process for using the Link Tool involves two steps: after selecting the Link Tool by clicking on it, click once on the point of origin, then click once on the destination, and the arrow will appear.



Example Processing Flow in the Main FlowChart Window

Setting Processing Step and Data Step Parameters

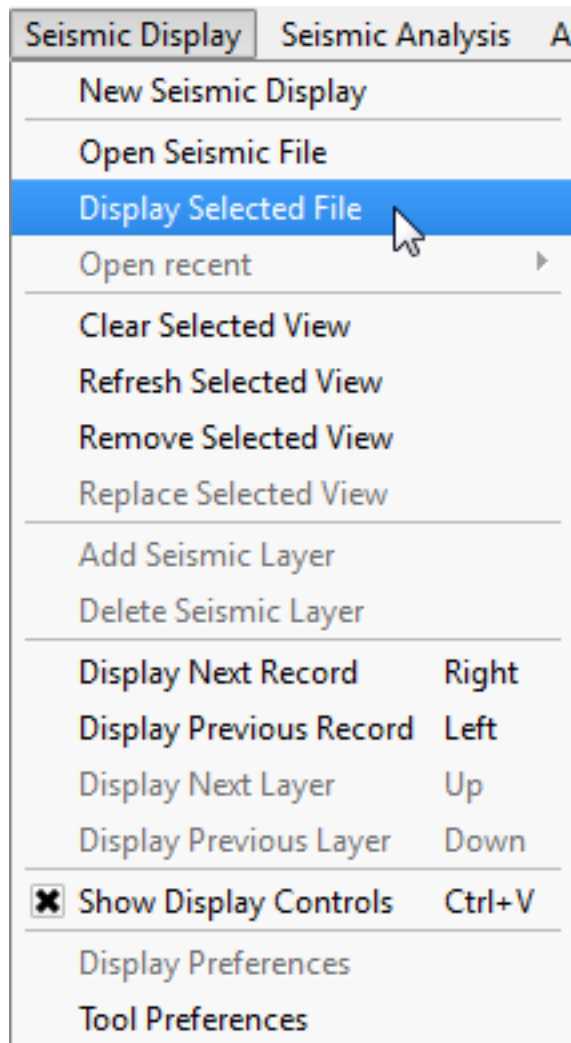
To set the parameters for a processing step, double left click on the step itself. This will display the dialog for setting the processing step parameters. Each dialog contains the parameters specific to that step. These parameters are set using numeric data entry fields, radio button controls, check boxes and drop down list boxes.



Step Parameter Dialog

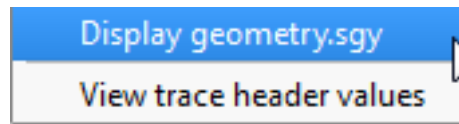
Displaying Seismic Data

To display a seismic file, first select a seismic data item in the flowchart by clicking on it. You may then issue the Display selected file command in a new page or add the display to a previously selected page.



Display Selected File Command

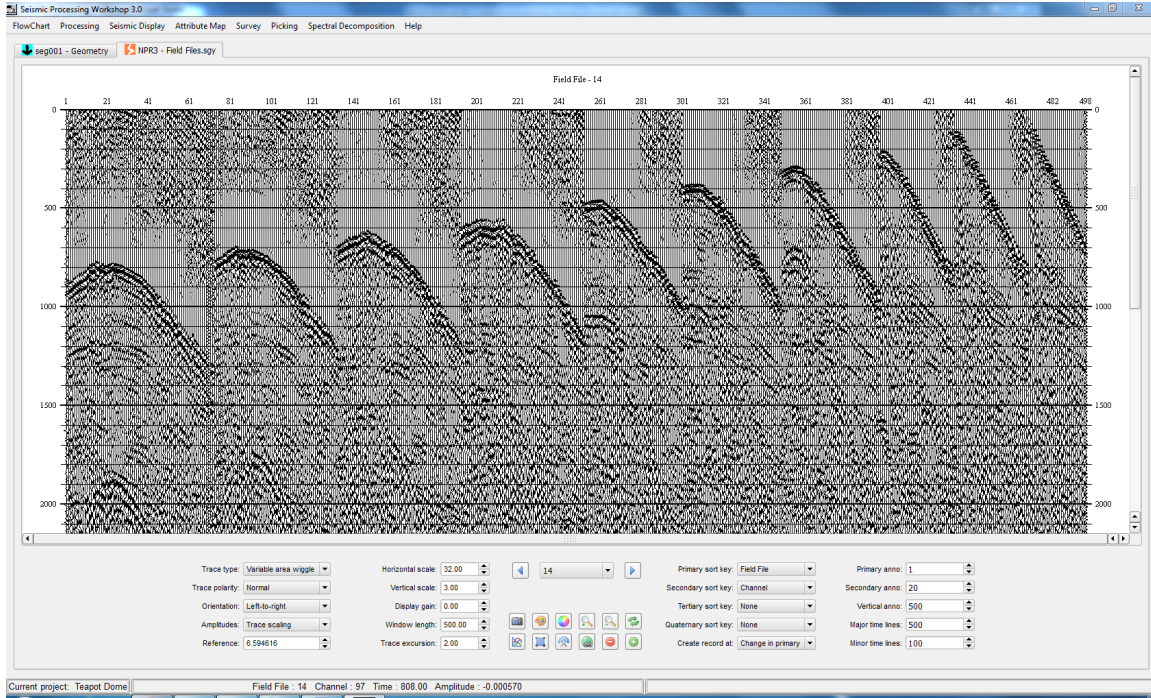
You may also display a seismic file by using the right mouse button. Click with the right mouse button on a seismic item on the flowchart and a context sensitive menu will appear.



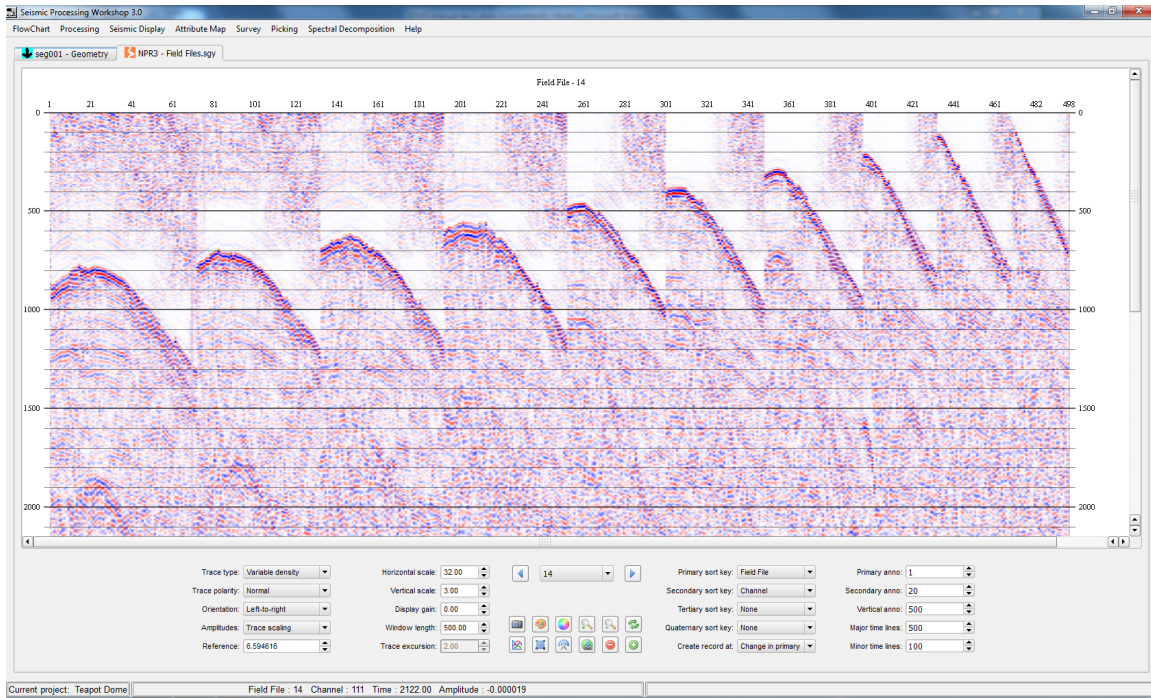
Context Menu for Seismic Display

The Seismic Display

The SPW 3 Seismic Display is a very simple but powerful display tool allowing you to freely adjust the display parameters and step through, or scroll through, your data set.



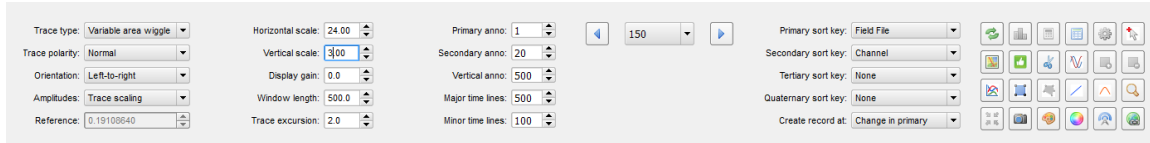
Variable Area Seismic Display



Variable Density Seismic Display

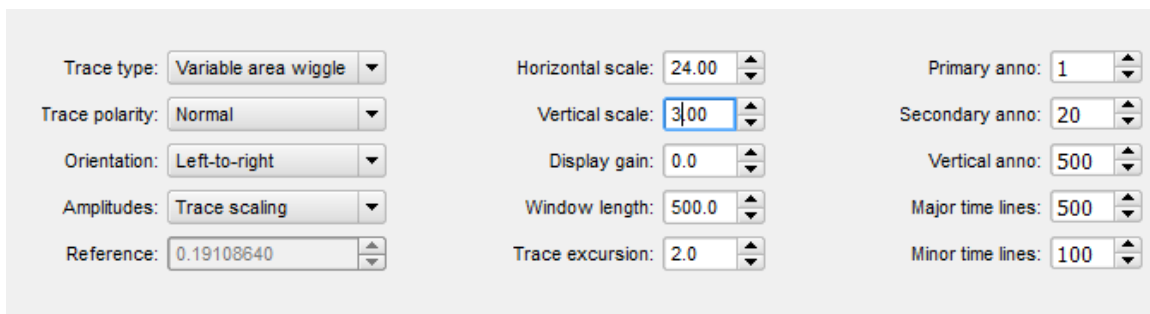
Seismic Display Control Panel

The SPW 3 Seismic Display Control Panel empowers you to select, set, or adjust parameters to best view your data.



Seismic Display Control Panel

Left Side of the Seismic Display Control Panel



Left Side of the Seismic Display Control Panel

Trace type – interactively adjusts the seismic display by type using a drop down menu.

Variable area is a “standard” black and white wiggle display with area fill.

Variable density is a color display, usually shown with a red-white-blue color scale.

Trace polarity – interactively adjusts the seismic display by polarity using a drop down menu.

Normal trace polarity interactively retains the polarity of seismic data on a trace-to-trace basis.

Reverse trace polarity interactively reverses the polarity of seismic data on a trace-to-trace basis.

Orientation – interactively adjusts the seismic display by orientation using a drop down menu.

Left-to-right displays the traces in ascending order starting from the left.

Right-to-left displays the traces in ascending order starting from the right.

Amplitudes – interactively adjusts the seismic display by amplitude using a drop down menu.

True amplitude displays the data at absolute input amplitude – usually millivolts.

Relative amplitude scales each trace to the same maximum amplitude.

Trace scaling applies an AGC to the trace using the Window length parameter.

Reference – interactively adjusts the seismic display by reference using up and down arrows, or numerical data entry.

Horizontal scale – interactively scales seismic data horizontally on a trace-to-trace basis using up and down arrows, or numerical data entry.

Vertical scale – interactively scales seismic data vertically on a trace-to-trace basis using up and down arrows, or numerical data entry.

Display gain – interactively gains seismic data on a trace-to-trace basis using up and down arrows, or numerical data entry.

Window length – interactively adjusts the length of the seismic display window using up and down arrows, or numerical data entry.

Trace excursion – interactively adjusts how far the seismic data extends on a trace-to-trace basis using up and down arrows, or numerical data entry.

Primary Anno – interactively changes the horizontal annotation of the seismic data according to the primary sort key display using up and down arrows, or numerical data entry.

Secondary Anno – interactively changes the horizontal annotation of the seismic data according to the secondary sort key display using up and down arrows, or numerical data entry.

Vertical Anno – interactively changes the vertical annotation of the seismic data display using up and down arrows, or numerical data entry.

Major Time Lines – interactively adjusts how frequently the major (bold) timing lines annotate the seismic data display using up and down arrows, or numerical data entry.

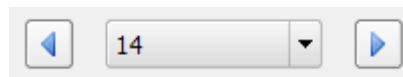
Minor Time Lines – interactively adjusts how frequently the minor (fine) timing lines annotate the seismic data display using up and down arrows, or numerical data entry.

Center of the Seismic Display Control Panel



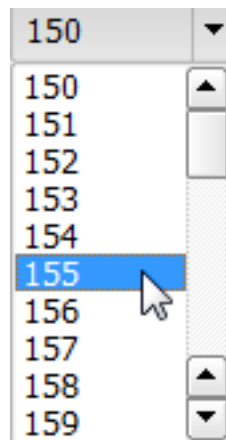
Center of the Seismic Display Control Panel

Select Sort Key Number



Select Sort Key Number

The feature at the top of the center of the Seismic Display Control Panel allows you to step through the entire list of records one by one, forwards or backwards. It also allows you to select an arbitrary primary sort key number by means of a drop down list displaying each one for quick selection anywhere in the data set.



Arbitrary Primary Number Drop-down List

Right Side of the Seismic Display Control Panel Tools



Primary sort key – interactively adjusts the seismic display by using a drop down menu to select the first order in sequence by which the data will be sorted.

Secondary sort key – interactively adjusts the seismic display by using a drop down menu to select the second order in sequence by which the data will be sorted.

Tertiary sort key – interactively adjusts the seismic display by using a drop down menu to select the third order in sequence by which the data will be sorted.

Quaternary sort key – interactively adjusts the seismic display by using a drop down menu to select the fourth order in sequence by which the data will be sorted.

Create record at – interactively creates a record by change in primary, secondary, tertiary, quaternary, each trace, or last trace.

There are large number of tools on the right side of the Seismic Display Control Panel which facilitate the manipulation of your data display.

Sort Data Tool

The Sort data tool button allows you to change the sort order in the visual display of your data.



Sort Data Tool

Clicking on this button changes the sort order of your data using current sort keys. When new sort keys are selected from the right side of the seismic display control panel, clicking on this button implements the selection.

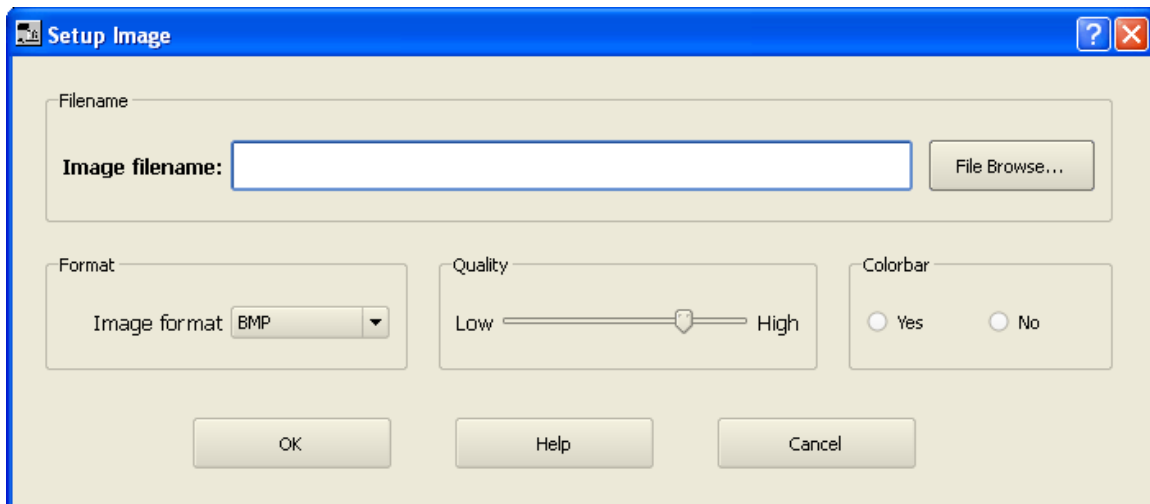
Capture an Image Tool

The Capture an image tool button allows you to create an image file of your seismic data display.



Capture an Image Tool

When you click on the button a Setup image dialog box appears.



Setup Image Dialog Box

Specify a name for the image file and browse for the destination. Then specify the format (BMP, JPEG, TIFF, PNG) from the Image format drop-down list. Set the image quality on the Low-High sliding continuum, and determine whether or not to use the Colorbar. Clicking OK captures the image and stores it in the project image folder.

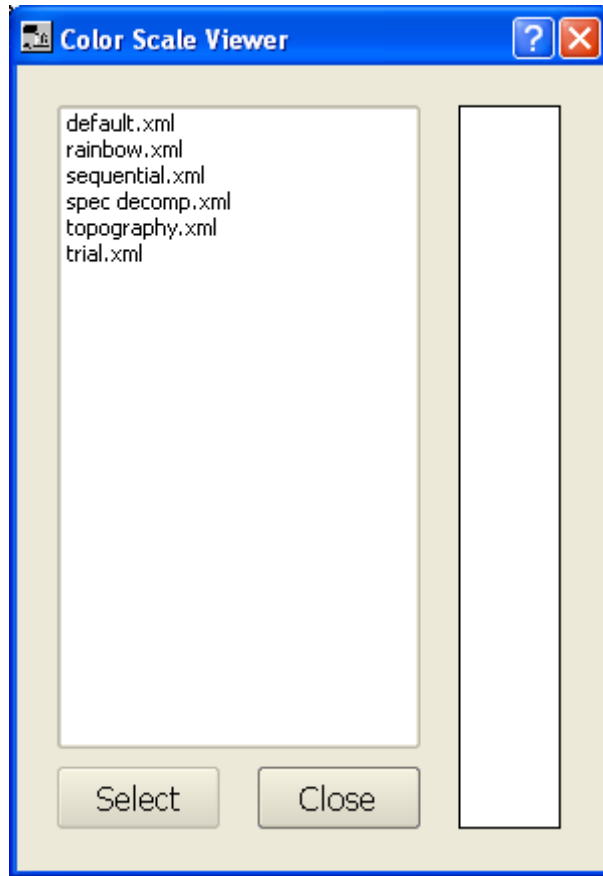
Select Color Scale Tool

The Select color scale tool button allows you to select from a variety of color scales to apply to your data.



Select Color Scale Tool

Clicking on this button opens the Color Scale Viewer dialog box from which you can select your preferred color scale.



Color Scale Viewer Dialog Box

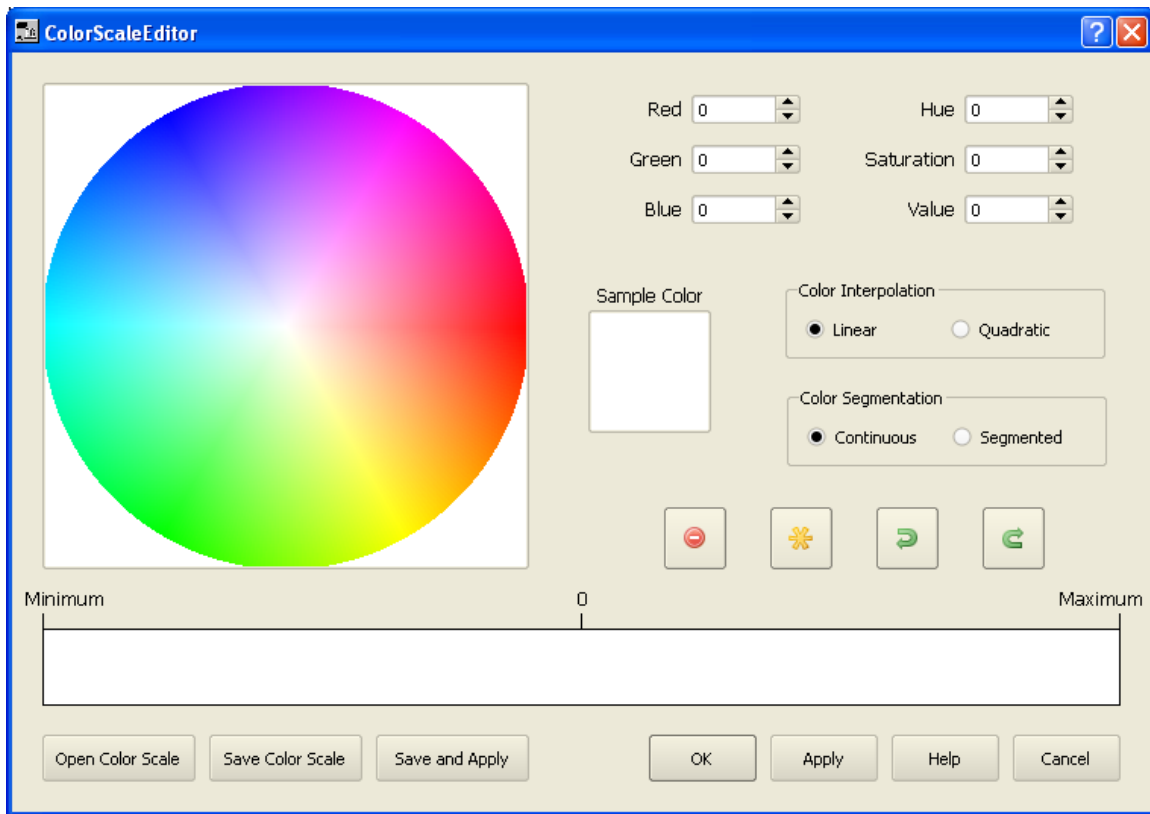
Create Color Scale Tool

The Create color scale tool button allows you to design your own color scale to apply to your data.



Create Color Scale Tool

Clicking on this button opens the ColorScaleEditor dialog box from which you can design your own color scale.



Color Scale Editor Dialog Box

Click on the color wheel to begin and adjust by using up and down arrows, or numerical data entry in the primary color boxes and the color feature boxes. Save your scales and apply using the Save and Apply button, or use the Select Color Scale Tool from which you can select your preferred color scale.

Zoom In Tool

The Zoom in tool button allows you to magnify the visual display of your data.



Clicking on this button narrows the area of focus and increases the size of your data.

Zoom Out Tool

The Zoom out tool button allows you to shrink the visual display of your data.



Zoom Out Tool

Clicking on this button widens the area of focus and decreases the size of your data.

Trace Amplitude Spectra Tool

The Trace amplitude spectra tool button is not implemented.



Trace Amplitude Spectra Tool

Area Amplitude Spectra Tool

The Area amplitude spectra tool button is not implemented.



Area Amplitude Spectra Tool

Propagate Display Setting Tool

The Propagate display setting tool button is not implemented.



Propagate Display Setting Tool

Synchronize Scrolling Tool

The Synchronize scrolling tool button is not implemented.



Synchronize Scrolling Tool

Delete a Pick Tool

The Delete a pick tool button is not implemented.



Delete a Pick Tool

Additional Display Parameters Tool

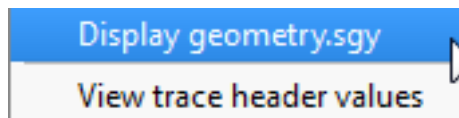
The Additional display parameters tool button is not implemented.



Additional Display Parameters Tool

Displaying Seismic Headers Spreadsheets

You may display the trace headers by first right clicking on a seismic data item on the flowchart, then second by selecting the View trace header values from the context menu.



Context menu for Seismic File

A screenshot of the 'Index Viewer - NFR3 - Binned.sgy' window. The window is divided into two main panes. The left pane, titled 'Trace Header Ranges', contains a table with three columns: 'Trace Header', 'Minimum Value', and 'Maximum Value'. It lists various seismic parameters and their ranges. The right pane, titled 'Trace Header Values', contains a large spreadsheet with columns: 'Byte position', 'Field File', 'Channel', 'CMP', 'CMP Line', 'CMP Location', 'Source Line', 'Source Location', and 'Receiver Line'. The spreadsheet displays 17 rows of data. Below the spreadsheet, there are sorting options: 'Primary sort key' (Field File), 'Secondary sort key' (Channel), 'Tertiary sort key' (None), and 'Quaternary sort key' (None). There is also a 'Record selection' section with a dropdown menu set to '14' and a 'Create record at' dropdown set to 'Change in primary'. At the bottom of the window are 'OK' and 'Close' buttons.

Trace Header	Minimum Value	Maximum Value
Field File Number	14	863
Channel Number	1	998
CMP	2019	2205
Inline	1007	1351
Crossline	2019	2205
Azimuth		
Offset	-19068.3	19115.8
CMP Easting	788366.75	809282.56
CMP Northing	939269.06	976889.50
CMP Elevation	4932.75	5531.20
Source Line	6006	6099
Source Location	6002	6174
Source Easting	788339.88	809248.62
Source Northing	939328.31	976916.12
Source Elevation	4934.30	5405.70
Source Datum	0.00	0.00
Source Depth	0.00	0.00
Source UHT	0	0
Source Component		
Receiver Line	2002	2174
Receiver Location	2007	2100
Receiver Easting	788393.69	809316.50
Receiver Northing	939209.81	976862.81
Receiver Elevation	4931.20	5656.70

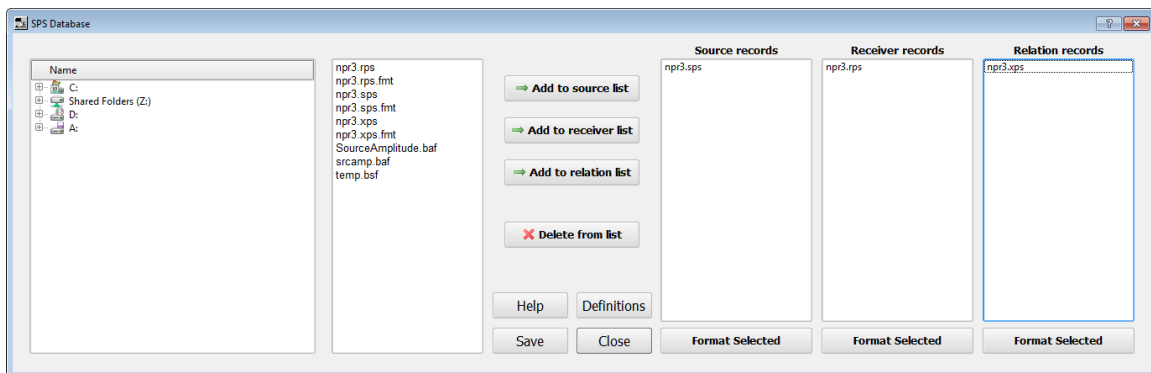
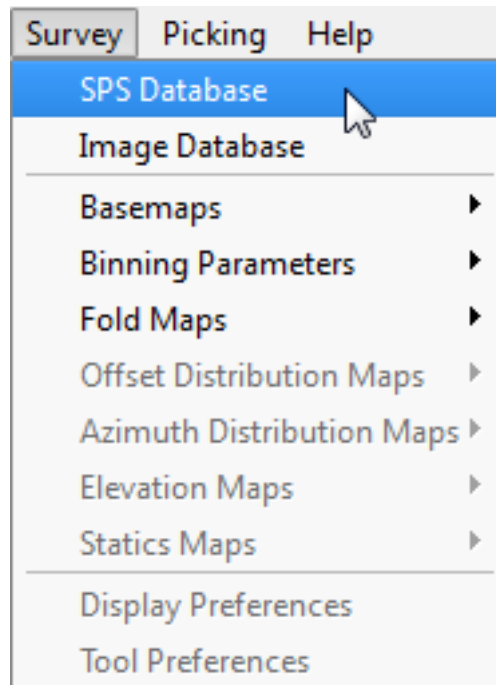
	Byte position	Field File	Channel	CMP	CMP Line	CMP Location	Source Line	Source Location	Receiver Line
1	3600	14	2	2036.0000	1044.0000	2036.0000	6023	6173.0000	2138
2	12036	14	3	2037.0000	1044.0000	2037.0000	6023	6173.0000	2138
3	20472	14	4	2038.0000	1044.0000	2038.0000	6023	6173.0000	2138
4	28908	14	5	2039.0000	1044.0000	2039.0000	6023	6173.0000	2138
5	37344	14	6	2040.0000	1044.0000	2040.0000	6023	6173.0000	2138
6	45780	14	7	2041.0000	1044.0000	2041.0000	6023	6173.0000	2138
7	54216	14	8	2042.0000	1044.0000	2042.0000	6023	6173.0000	2138
8	62652	14	9	2043.0000	1044.0000	2043.0000	6023	6173.0000	2138
9	71088	14	10	2044.0000	1044.0000	2044.0000	6023	6173.0000	2138
10	79524	14	11	2045.0000	1044.0000	2045.0000	6023	6173.0000	2138
11	87960	14	12	2046.0000	1044.0000	2046.0000	6023	6173.0000	2138
12	96396	14	13	2047.0000	1044.0000	2047.0000	6023	6173.0000	2138
13	104832	14	14	2048.0000	1044.0000	2048.0000	6023	6173.0000	2138
14	113268	14	15	2049.0000	1044.0000	2049.0000	6023	6173.0000	2138
15	121704	14	16	2050.0000	1044.0000	2050.0000	6023	6173.0000	2138
16	130140	14	17	2051.0000	1044.0000	2051.0000	6023	6173.0000	2138
17	138576	14	18	2052.0000	1044.0000	2052.0000	6023	6173.0000	2138

Spreadsheet Display of Seismic Trace Headers

In the seismic trace header display, the headers are displayed in gather order and split by gathers. The Record selection (see directional arrows at the bottom of the display) allows you to move through the gathers or jump to a specific gather by number.

The SPS Database

SPS files are tied to the current project using the SPS Database.



SPS Database Definition

Select SPS files and add them to the correct column based on their data type. Individual formats may be defined to correctly read each sps file.

The Image Database

Image files are tied to the current project using the Image Database.

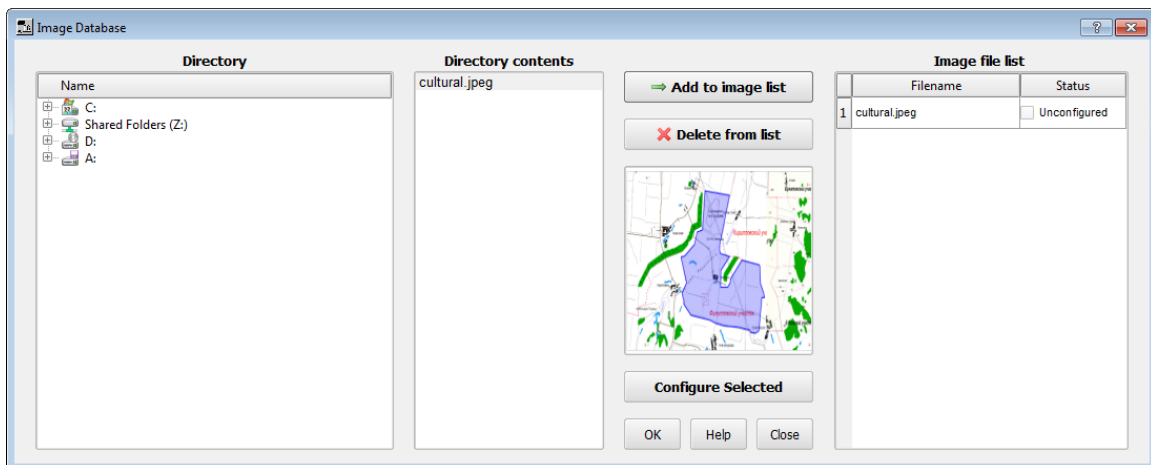
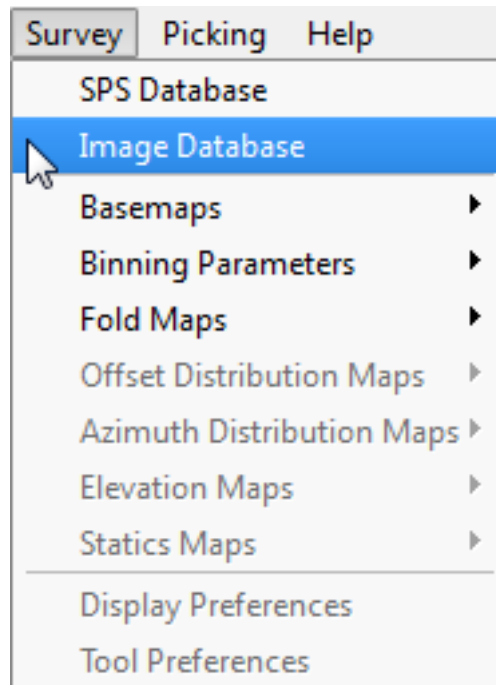


Image Database Definition

Select your background image files and add them to the project. Then you can select each image and configure the coordinates for the image to be drawn on maps.

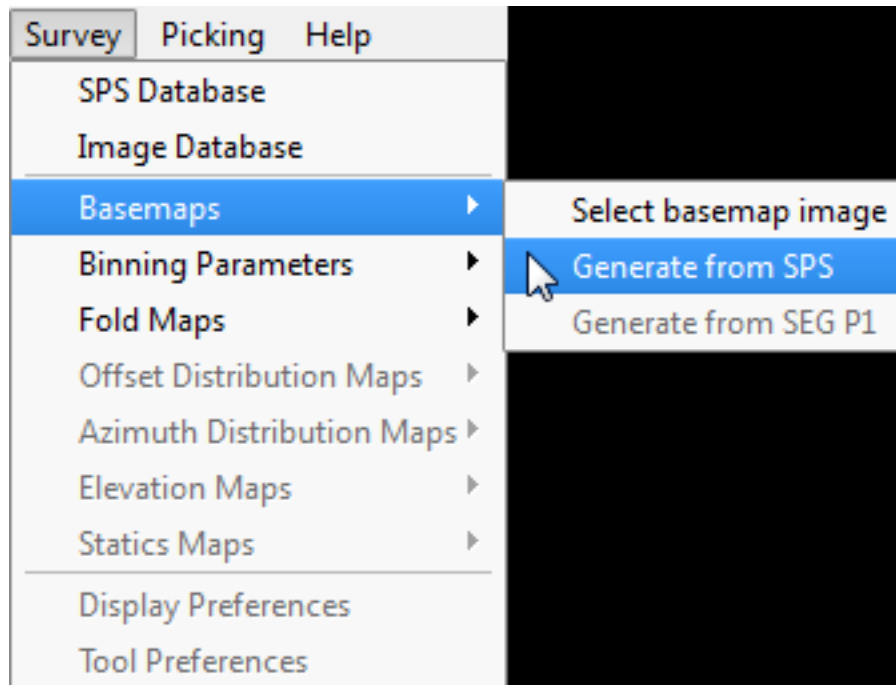
Map Displays

Map displays are new in SPW 3. There are a number of different types including base maps, fold maps and attribute maps.

The Basemap

Basemaps are generated from SPS geometry files. The geometry files must be in the Survey directory of a project.

Displaying a Survey Basemap



When you select the Basemap->Generate from SPS command, for a 3D dataset, you will see the dialog shown below:

Select Basemap Inputs

SPS file selection

Source file	Map	Receiver file	Map	Relation file	Map
npr3.sps	<input checked="" type="checkbox"/>	npr3.rps	<input checked="" type="checkbox"/>	npr3.xps	<input type="checkbox"/>

Exclusion zones

☐ Display exclusion zones on basemap

Add File

Remove File

Exclusion file	Format
----------------	--------

Background image

☐ Display background image on basemap

Load Image

Configure

Unload image

☐ Loaded

☐ Configured

Map title

Teapot Dome

Map label

Source and Receiver Positions

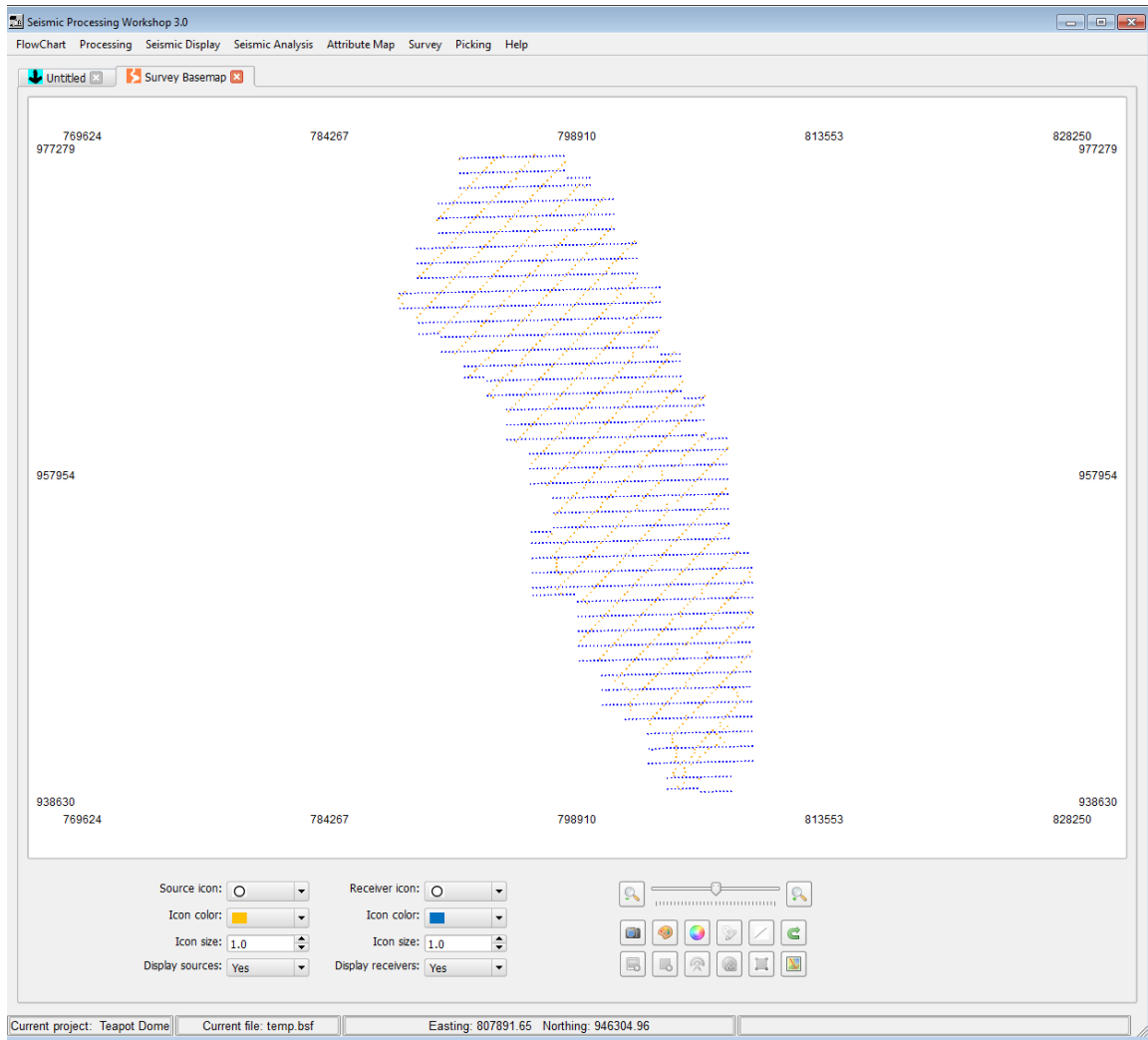
Map output

Basemap name: File Browse...

OK Help Cancel

Survey 3D Basemap Dialog

You can select from the SPS files from the SPS database. You can also display a background image file and exclusion zones on the basemap.



Survey 3D Basemap Display

Base Map Display Control Panel

Source icon:	Receiver icon:	
Icon color:	Icon color:	
Icon size:	Icon size:	
Display sources:	Display receivers:	



Zoom Out



Zoom In



Output Image File



Color Palette



Color Wheel



Customize Map Annotations



Redraw Map



Redo



Propagate Display Settings



Synchronize Scrolling

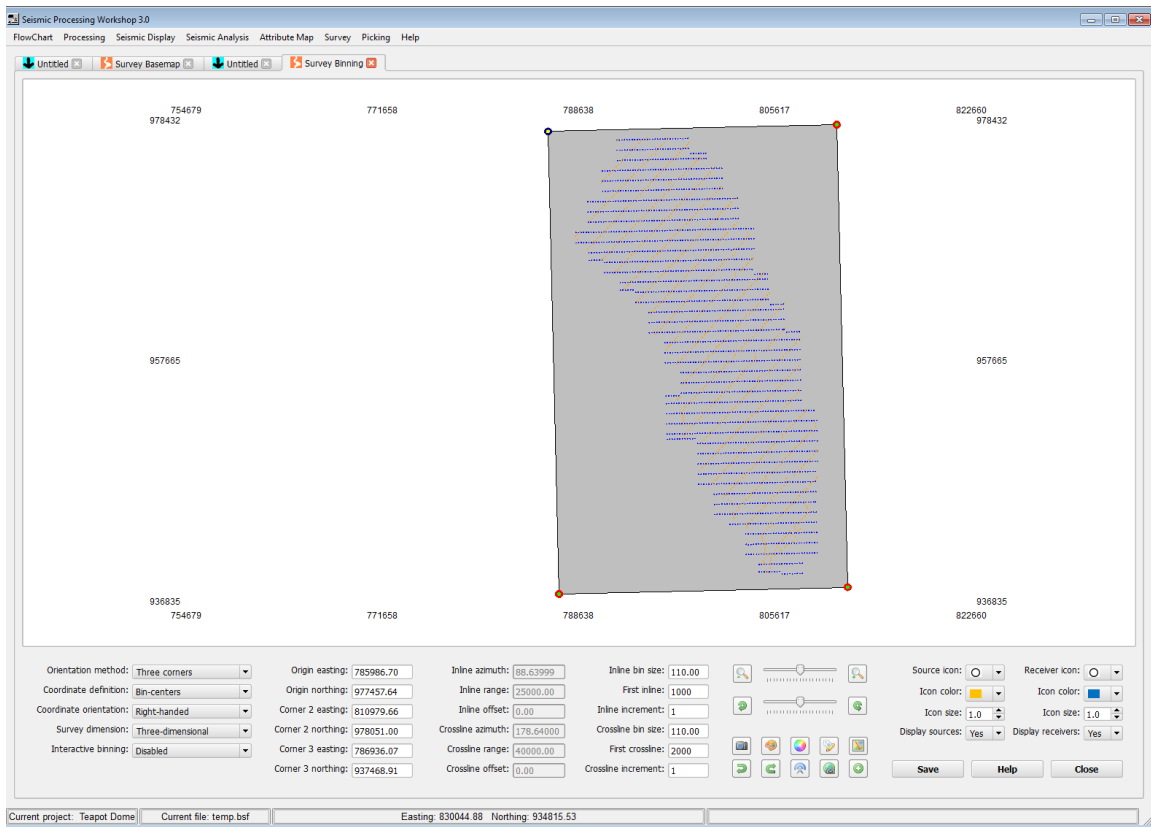
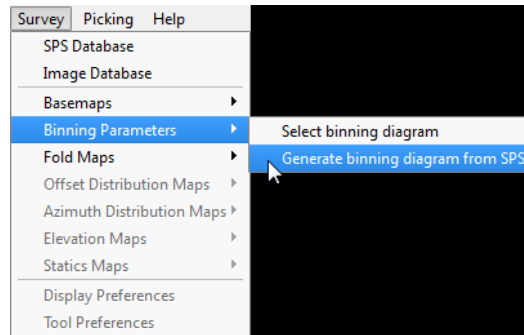


Additional Display Settings

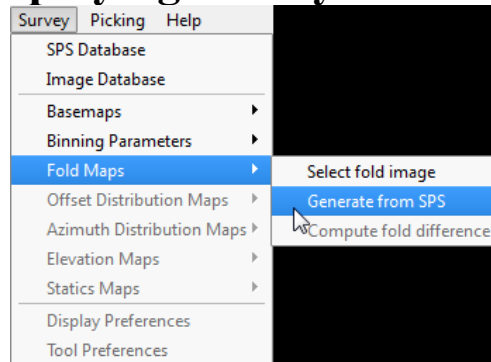
Attribute Maps

Attribute maps can be generated from seismic files to show the variation of certain properties of the data in a map view. Amplitude and frequency attributes are commonly used to quality control data. The Amplitude Analysis and Frequency Analysis processing steps are commonly used to generate these attributes and save them in the seismic trace headers.

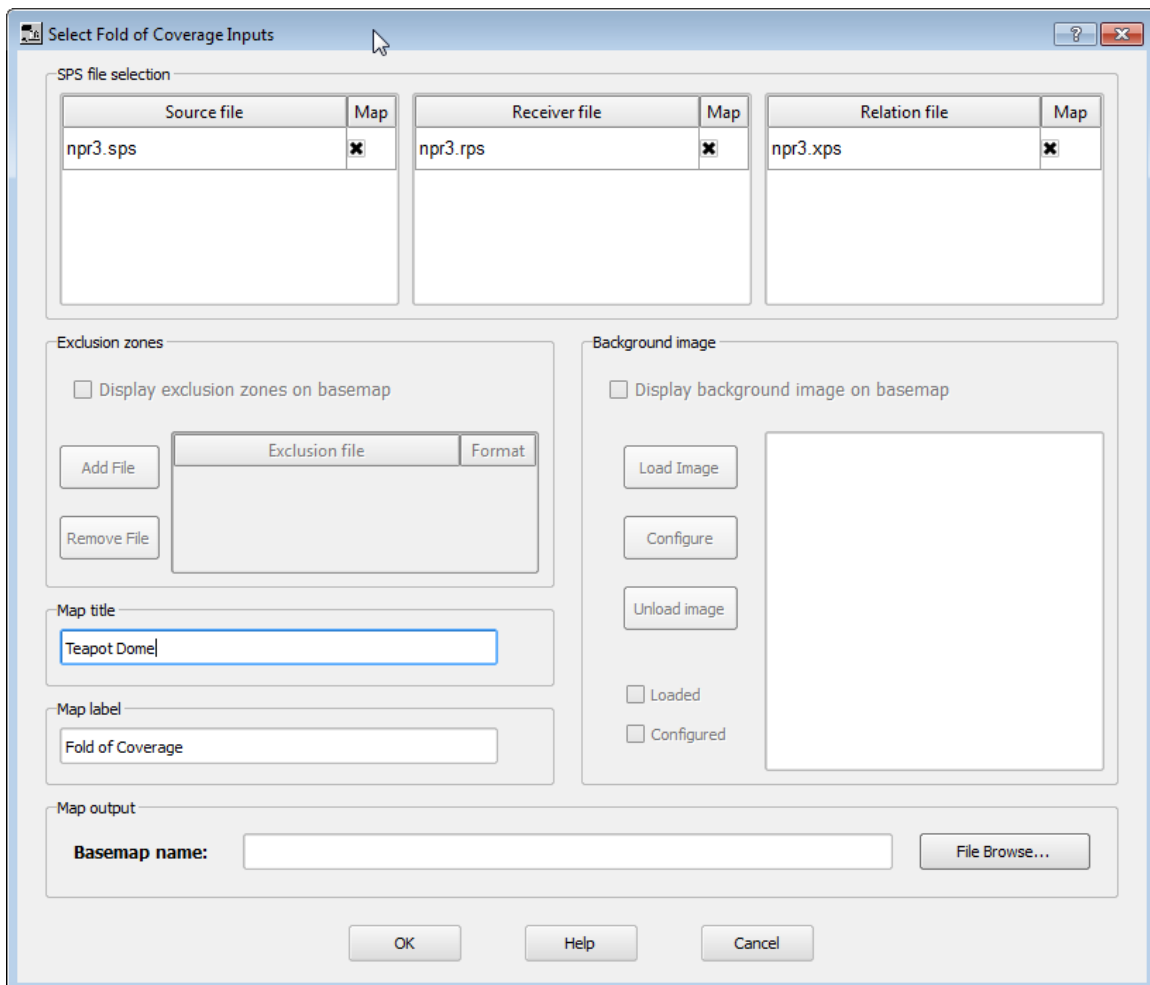
Interactive CMP Bin Definition



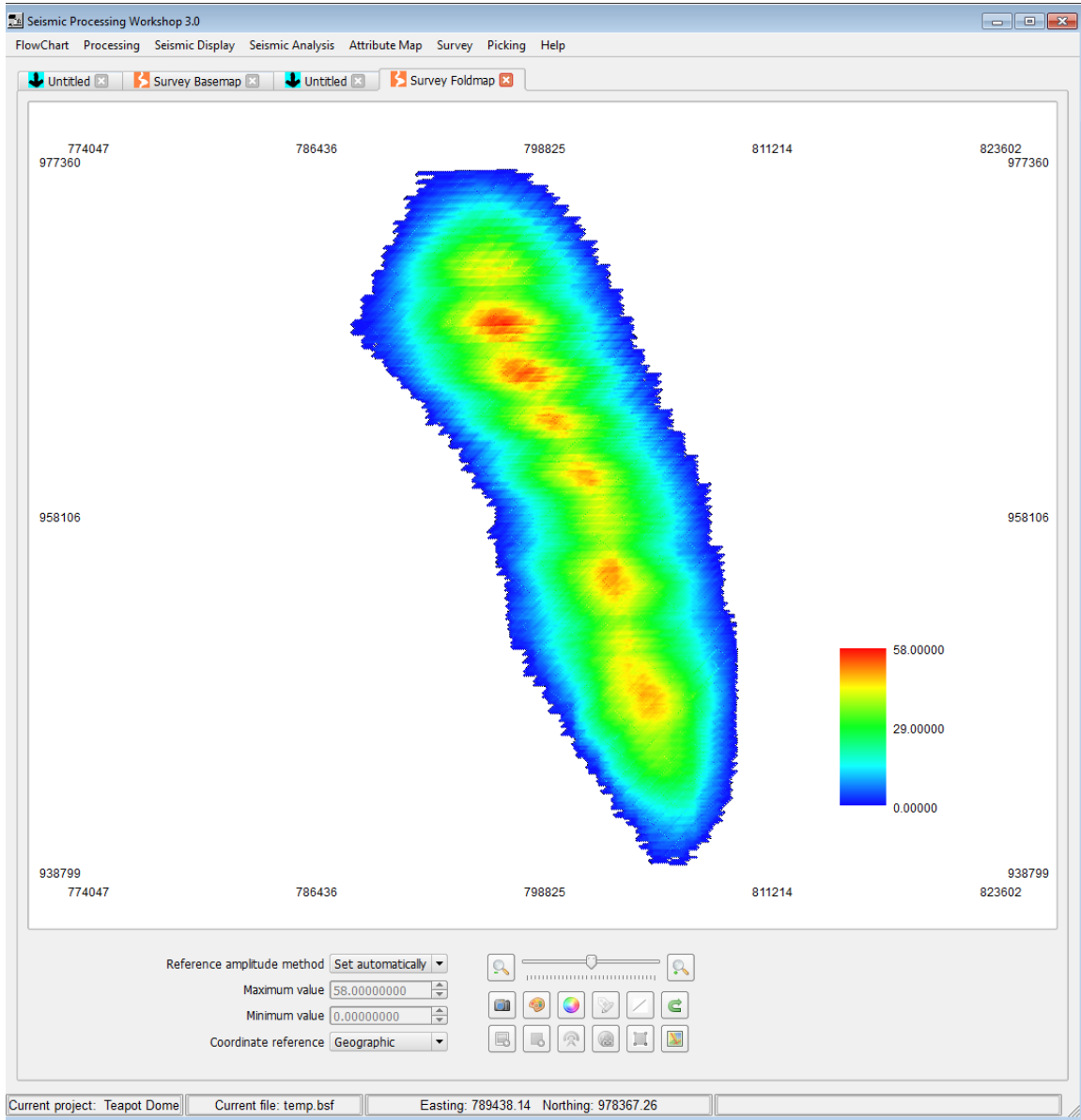
Displaying Survey Fold Map



When you select the Fold->Generate fold from SPS command, for a 3D dataset, you will see the parameter dialog shown below for creating a fold map.



Selecting the appropriate SPS files and any background and/or exclusion zones that you wish to display will result in creating an annotated fold map as is shown below.



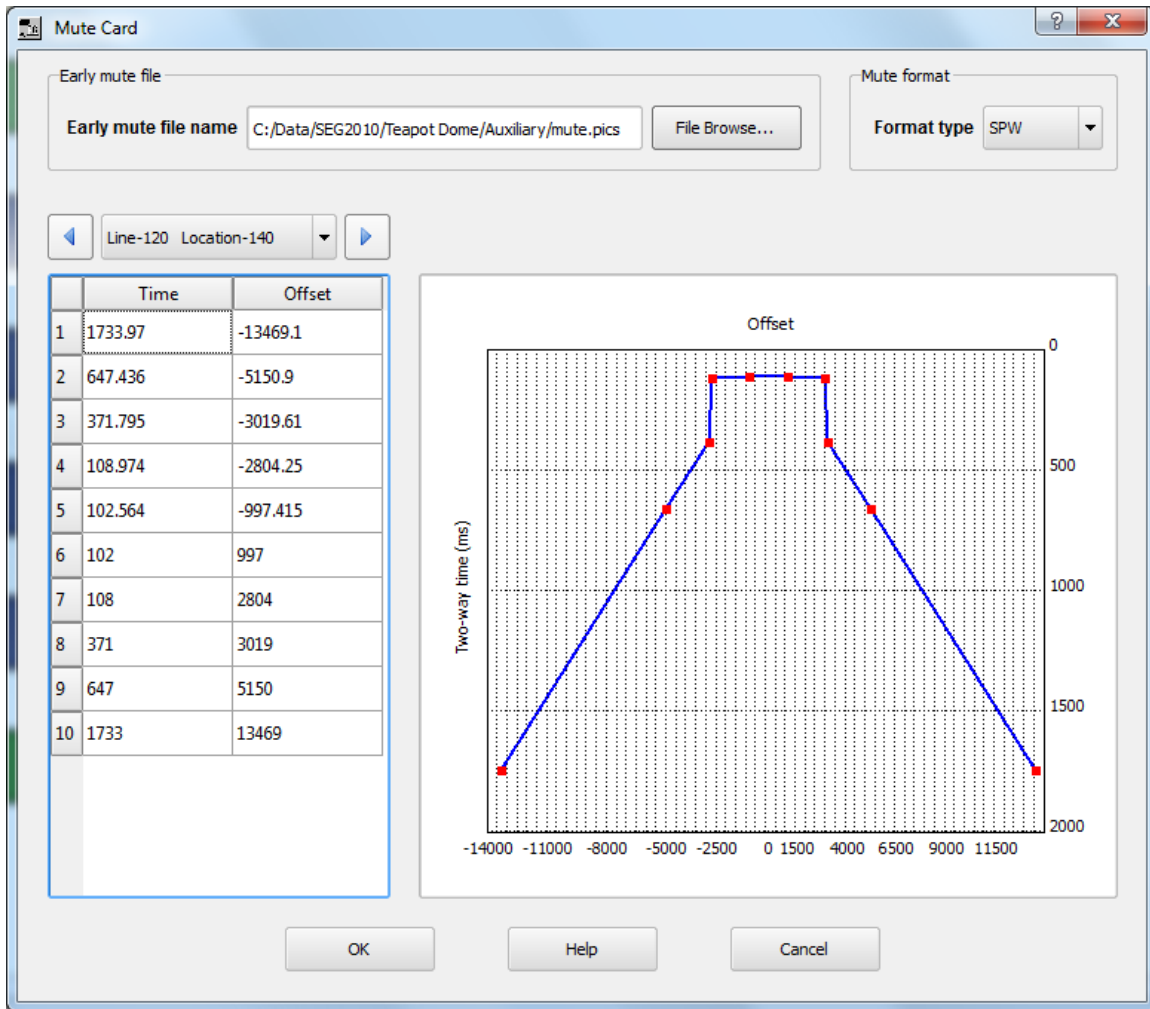
Survey 3D Fold Map Display

Displaying Spreadsheets of Auxiliary Data

Each of the Auxiliary data types has a unique display and spreadsheet view which is customized for that spreadsheet's specific data type and contents. The following pages show examples of the spreadsheet views for a number of the data types. Each spreadsheet also has controls allowing you to move between displays. For example, Velocity Functions exist in multiple locations in a 3D survey at specific CMP Line and CMP Location positions. You can move between control points using the control at the top of the spreadsheet where it shows the Line and Location.

Early Mute Functions

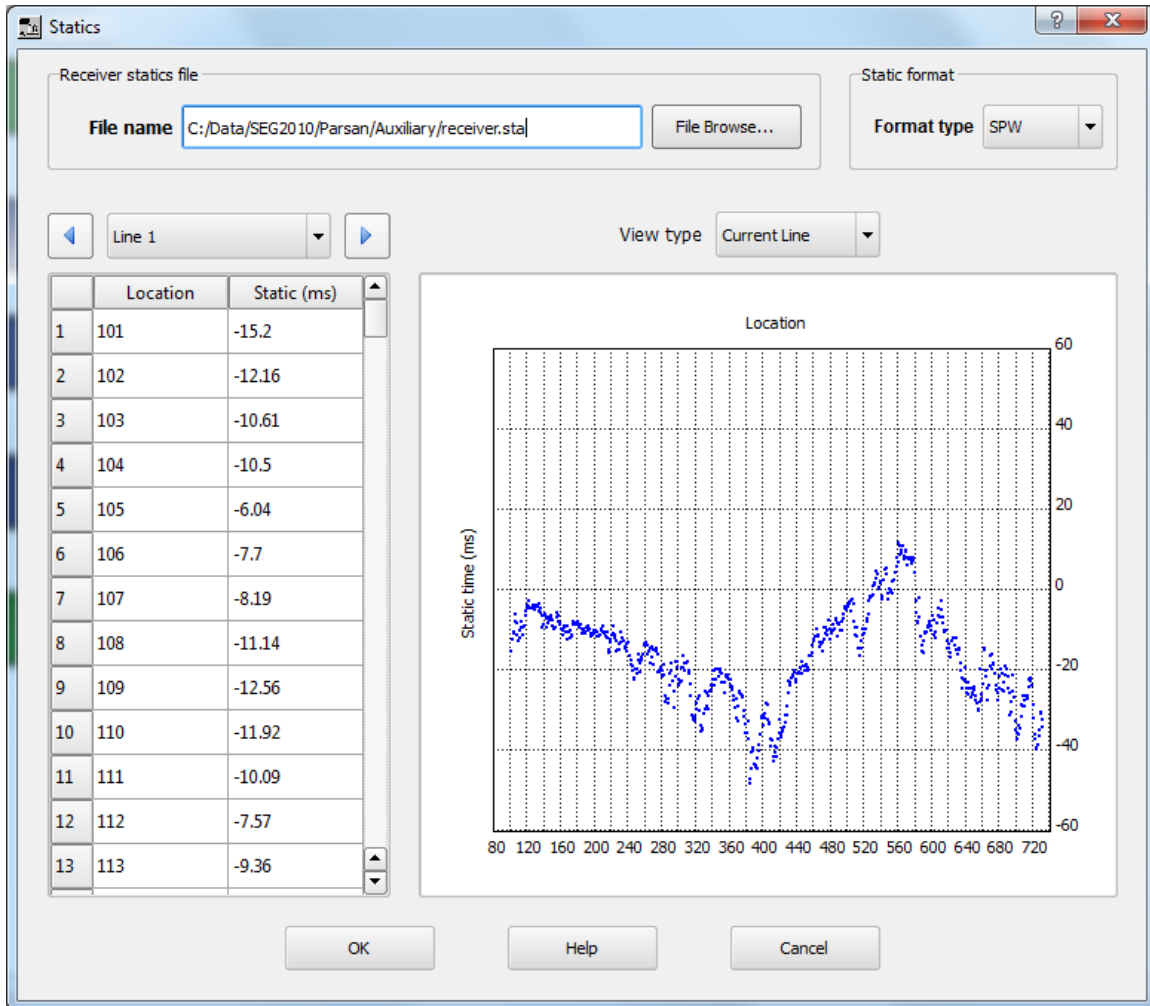
Mute functions are defined by time offset pairs. They are usually picked on a few gathers in the dataset and interpolated between these control points.



SPW Early Mute Function Spreadsheet

Receiver Statics

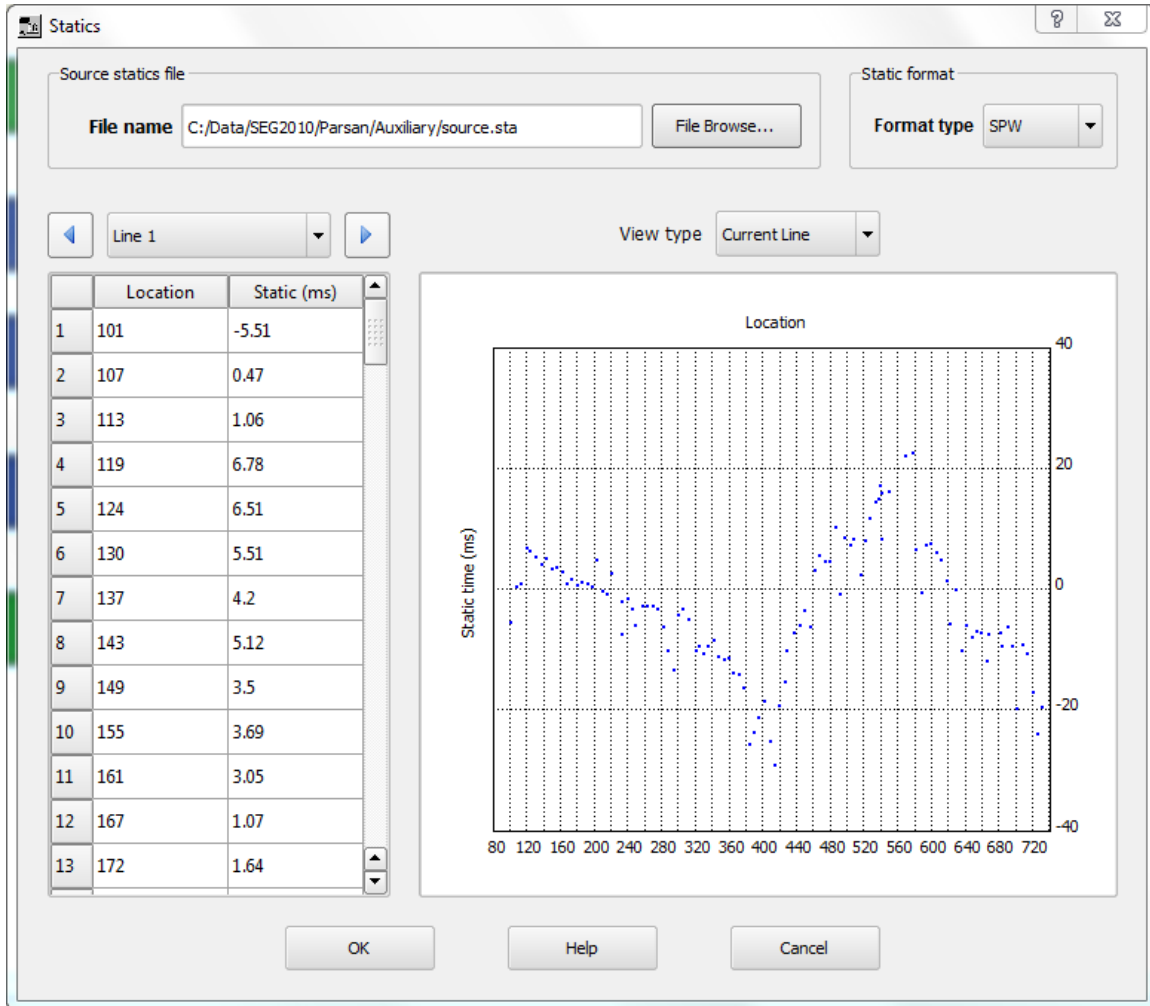
The receiver statics are displayed on a line by line basis. You can move through the lines in a 3D survey by selecting the lines above the spreadsheet columns using the directional arrows.



SPW Receiver Statics

Source Statics

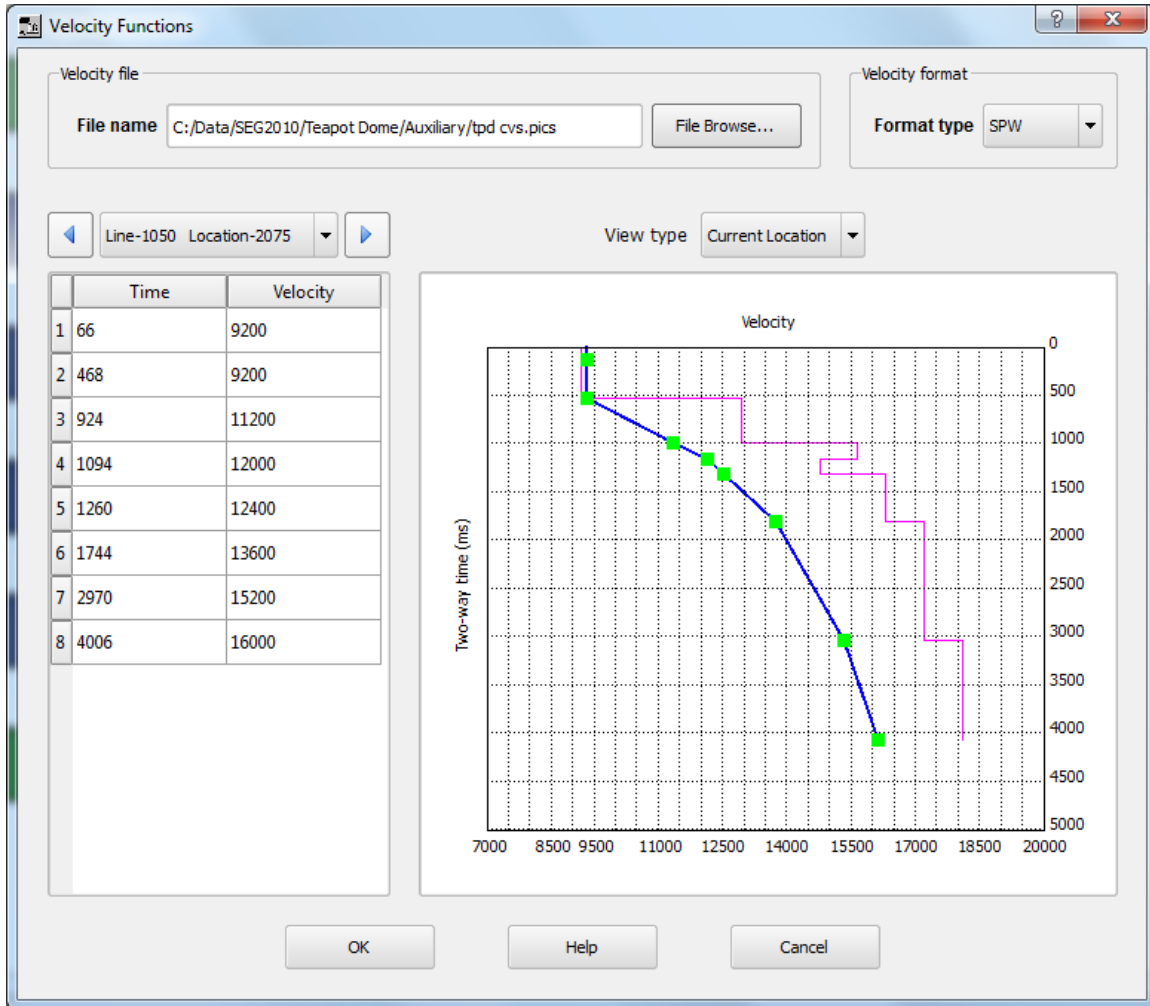
The source statics are displayed on a line by line basis. You can move through the lines in a 3D survey by selecting the lines above the spreadsheet columns using the directional arrows.



SPW Source Statics

Velocity Functions

Velocity functions are defined by time offset pairs. They are usually picked on selected gathers throughout the dataset and interpolated between these control points.



SPW Velocity Function Spreadsheet

SPS Observers Notes

The SPS Relation Record displays Observers Notes in a tabbed worksheet. Use the File Browse to select your XPS file and the spreadsheet will open displaying the contents. If it is not correct or nothing is displayed then you should use the Analyze Format button at the bottom of the display to define how these data are read.

The screenshot shows the 'SPS Relation Record' application window. At the top, there is a 'Relation record file name' field containing the path 'C:/Teapot Dome/Survey/npr3.xps' and a 'File Browse...' button. Below this is a 'Spreadsheet' tab containing a table with 8 columns: Record ID, Tape number, Record number, Record index, Instrument code, Source line number, and Source point number. The table contains 23 rows of data. At the bottom of the window are five buttons: 'Close', 'Analyze Format', 'Help', 'Save changes', and 'Save as ...'.

	Record ID	Tape number	Record number	Record index	Instrument code	Source line number	Source point number
1		0	14	0		6023	6173
2		0	14	0		6023	6173
3		0	14	0		6023	6173
4		0	14	0		6023	6173
5		0	14	0		6023	6173
6		0	14	0		6023	6173
7		0	14	0		6023	6173
8		0	14	0		6023	6173
9		0	14	0		6023	6173
10		0	14	0		6023	6173
11		0	15	0		6024	6174
12		0	15	0		6024	6174
13		0	15	0		6024	6174
14		0	15	0		6024	6174
15		0	15	0		6024	6174
16		0	15	0		6024	6174
17		0	15	0		6024	6174
18		0	15	0		6024	6174
19		0	15	0		6024	6174
20		0	15	0		6024	6174
21		0	17	0		6018	6158
22		0	17	0		6018	6158
23		0	17	0		6018	6158

SPS Relation Record: Spreadsheet Tab

The SPS Analyzer allows you to specify how the data will be read and decoded from this sps file. When the format is correctly defined, be sure to Save.

SPS Analyzer

Relation Record Identification

Record identification ☐ Read lines with relation record ID "X" First line to read

	Start Col.	End Col.	Load	Minimum	Maximum
Tape number	<input type="text" value="2"/>	<input type="text" value="7"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Record number	<input type="text" value="8"/>	<input type="text" value="11"/>	<input type="checkbox"/>	<input type="text" value="14"/>	<input type="text" value="863"/>
Record increment	<input type="text" value="12"/>	<input type="text" value="12"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Instrument code	<input type="text" value="13"/>	<input type="text" value="13"/>	<input type="checkbox"/>	<input type="text" value=""/>	<input type="text" value=""/>
Source line	<input type="text" value="14"/>	<input type="text" value="29"/>	<input type="checkbox"/>	<input type="text" value="6006"/>	<input type="text" value="6099"/>
Source location	<input type="text" value="30"/>	<input type="text" value="37"/>	<input type="checkbox"/>	<input type="text" value="6002"/>	<input type="text" value="6174"/>
Source index	<input type="text" value="38"/>	<input type="text" value="38"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

	Start Col.	End Col.	Load	Minimum	Maximum
From channel	<input type="text" value="39"/>	<input type="text" value="42"/>	<input type="checkbox"/>	<input type="text" value="-57"/>	<input type="text" value="940"/>
To channel	<input type="text" value="43"/>	<input type="text" value="46"/>	<input type="checkbox"/>	<input type="text" value="-12"/>	<input type="text" value="998"/>
Channel increment	<input type="text" value="47"/>	<input type="text" value="47"/>	<input type="checkbox"/>	<input type="text" value="1"/>	<input type="text" value="1"/>
Receiver line	<input type="text" value="48"/>	<input type="text" value="63"/>	<input type="checkbox"/>	<input type="text" value="2002"/>	<input type="text" value="2174"/>
From receiver	<input type="text" value="64"/>	<input type="text" value="71"/>	<input type="checkbox"/>	<input type="text" value="2007"/>	<input type="text" value="2094"/>
To receiver	<input type="text" value="72"/>	<input type="text" value="79"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Receiver index	<input type="text" value="80"/>	<input type="text" value="80"/>	<input type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
14 6023 6173 2 72 12138 2007 2077 1
14 6023 6173 73 132 12142 2012 2071 1
14 6023 6173 133 192 12146 2012 2071 1
14 6023 6173 193 252 12150 2012 2071 1
14 6023 6173 253 300 12154 2018 2065 1
14 6023 6173 301 348 12158 2018 2065 1
14 6023 6173 349 396 12162 2018 2065 1
14 6023 6173 397 432 12166 2024 2059 1
14 6023 6173 433 468 12170 2024 2059 1
14 6023 6173 469 497 12174 2024 2052 1
15 6024 6174 2 72 12138 2007 2077 1
15 6024 6174 73 132 12142 2012 2071 1
15 6024 6174 133 192 12146 2012 2071 1
15 6024 6174 193 252 12150 2012 2071 1
15 6024 6174 253 300 12154 2018 2065 1
15 6024 6174 301 348 12158 2018 2065 1
15 6024 6174 349 396 12162 2018 2065 1
15 6024 6174 397 432 12166 2024 2059 1
15 6024 6174 433 468 12170 2024 2059 1
15 6024 6174 469 497 12174 2024 2052 1
17 6018 6158 1 71 12134 2007 2077 1
17 6018 6158 73 143 12138 2007 2077 1
17 6018 6158 144 203 12142 2012 2071 1
17 6018 6158 204 263 12146 2012 2071 1
17 6018 6158 264 323 12150 2012 2071 1
17 6018 6158 324 371 12154 2018 2065 1
17 6018 6158 372 419 12158 2018 2065 1
17 6018 6158 420 467 12162 2018 2065 1
17 6018 6158 468 503 12166 2024 2059 1
17 6018 6158 504 538 12170 2024 2059 1

Save Format Help Close

SPS Relation Record: Record Analysis Tab

SPS Receiver Locations

The SPS Point Record displays Receiver Locations in a tabbed worksheet. Use the File Browse to select your RPS file and the spreadsheet will open displaying the contents. If it is not correct or nothing is displayed then you should use the Analyze Format button at the bottom of the display to define how these data are read.

The screenshot shows the 'SPS Point Record' application window. At the top, there's a 'SPS Source Record' section with a text field for 'Source record file name' containing 'C:/Teapot Dome/Survey/npr3.sps' and a 'File Browse...' button. Below this are two tabs: 'Spreadsheet' (selected) and 'Map'. The 'Spreadsheet' tab displays a table with 8 columns: Record ID, Line name, Point number, Point index, Point code, Static correction, and Point depth. The table contains 23 rows of data. At the bottom of the window are five buttons: 'Close', 'Analyze Format', 'Help', 'Save changes', and 'Save as ...'.

	Record ID	Line name	Point number	Point index	Point code	Static correction	Point depth
1		6006	6136	0		0	0.0
2		6007	6135	0		0	0.0
3		6007	6137	0		0	0.0
4		6008	6138	0		0	0.0
5		6011	6131	0		0	0.0
6		6012	6132	0		0	0.0
7		6012	6142	0		0	0.0
8		6013	6133	0		0	0.0
9		6013	6143	0		0	0.0
10		6014	6134	0		0	0.0
11		6014	6144	0		0	0.0
12		6015	6135	0		0	0.0
13		6015	6145	0		0	0.0
14		6016	6136	0		0	0.0
15		6016	6146	0		0	0.0
16		6017	6127	0		0	0.0
17		6017	6137	0		0	0.0
18		6017	6147	0		0	0.0
19		6017	6157	0		0	0.0
20		6018	6128	0		0	0.0
21		6018	6138	0		0	0.0
22		6018	6148	0		0	0.0
23		6018	6158	0		0	0.0

SPS Receiver Record: Spreadsheet Tab

The SPS Analyzer allows you to specify how the data will be read and decoded from this sps file. When the format is correctly defined, be sure to Save.

SPS Analyzer

Source Record identification

Record identification Start Col End Col ☐ Read lines with source record ID "S" First line to read

	Start Col.	End Col.	Load	Minimum	Maximum		Start Col.	End Col.	Load	Minimum	Maximum
Source line	<input type="text" value="2"/>	<input type="text" value="17"/>	<input checked="" type="checkbox"/>	<input type="text" value="6006"/>	<input type="text" value="6099"/>	Source static	<input type="text" value="29"/>	<input type="text" value="32"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Source location	<input type="text" value="18"/>	<input type="text" value="25"/>	<input checked="" type="checkbox"/>	<input type="text" value="6002"/>	<input type="text" value="6174"/>	Source depth	<input type="text" value="33"/>	<input type="text" value="36"/>	<input checked="" type="checkbox"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>
Source index	<input type="text" value="26"/>	<input type="text" value="26"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	Source datum	<input type="text" value="37"/>	<input type="text" value="40"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Source code	<input type="text" value="27"/>	<input type="text" value="28"/>	<input checked="" type="checkbox"/>	<input type="text" value=""/>	<input type="text" value=""/>	Source uphole	<input type="text" value="41"/>	<input type="text" value="42"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Source easting	<input type="text" value="47"/>	<input type="text" value="55"/>	<input checked="" type="checkbox"/>	<input type="text" value="788339.9"/>	<input type="text" value="809248.6"/>	Water depth	<input type="text" value="43"/>	<input type="text" value="46"/>	<input checked="" type="checkbox"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>
Source northing	<input type="text" value="56"/>	<input type="text" value="65"/>	<input checked="" type="checkbox"/>	<input type="text" value="939328.3"/>	<input type="text" value="976916.1"/>	Recording date	<input type="text" value="72"/>	<input type="text" value="74"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Source elevation	<input type="text" value="66"/>	<input type="text" value="71"/>	<input checked="" type="checkbox"/>	<input type="text" value="4934.3"/>	<input type="text" value="5405.7"/>	Recording time	<input type="text" value="75"/>	<input type="text" value="80"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

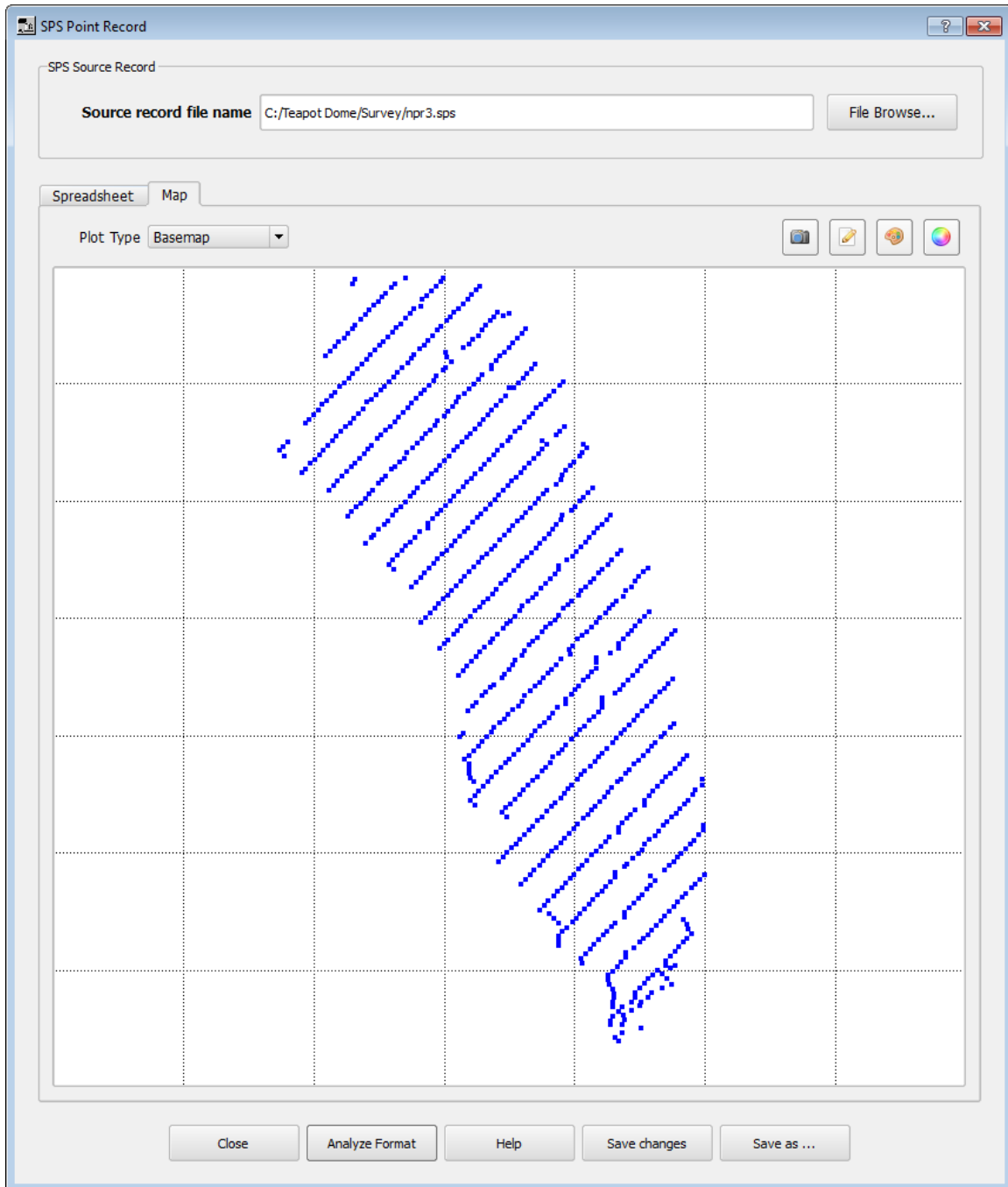
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

6007	6135	788557.50968125.5005032.8
6006	6136	788339.90968428.3005034.7
6007	6137	788507.30968604.0005030.7
6008	6138	788721.80968829.7005025.7
6011	6131	789417.60967306.9004993.6
6012	6132	789618.20967516.7004987.3
6012	6142	789581.30969730.6005016.3
6013	6133	789848.30967755.4004992.0
6013	6143	789795.20969955.7005011.3
6014	6134	790061.30967981.0004993.0
6014	6144	790009.80970179.4005010.3
6015	6135	790276.90968207.8005013.7
6015	6145	790225.20970405.5005001.7
6016	6136	790491.40968430.5005000.0
6016	6146	790418.00970697.1005007.3
6017	6127	790757.90966457.4005039.0
6017	6137	790706.20968655.9004982.7
6017	6147	790655.00970855.9005008.6
6017	6157	790603.20973055.2005044.5
6018	6128	790973.10966681.6005042.1
6018	6138	790920.90968880.6004983.5
6018	6148	790869.10971080.4005003.5
6018	6158	790817.50973280.6005048.3
6019	6129	791187.20966906.8005060.7
6019	6139	791134.00969106.4004983.5
6019	6149	791064.40971284.9005006.8
6019	6159	791032.60973506.7005051.6
6020	6130	791402.70967131.6005080.5
6020	6140	791350.30969331.8004976.2
6020	6150	791208.60971530.0005006.7

Save Format Help Close

SPS Receiver Record: Record Analysis Tab

The SPS Point Record also has a tab for map display. The Map tab allows you to specify the Plot Type. The default is Basemap.



SPS Receiver Record: Basemap

SPS Source Locations

The SPS Point Record displays Source Locations in a tabbed worksheet. Use the File Browse to select your SPS file and the spreadsheet will open displaying the contents. If it is not correct or nothing is displayed then you should use the Analyze Format button at the bottom of the display to define how these data are read.

The screenshot shows the 'SPS Point Record' application window. At the top, there's a 'Source record file name' field containing 'C:/Teapot Dome/Survey/npr3.sps' and a 'File Browse...' button. Below this, there are two tabs: 'Spreadsheet' (selected) and 'Map'. The 'Spreadsheet' tab displays a table with 8 columns: Record ID, Line name, Point number, Point index, Point code, Static correction, and Point depth. The table contains 23 rows of data. At the bottom of the window, there are five buttons: 'Close', 'Analyze Format', 'Help', 'Save changes', and 'Save as ...'.

Record ID	Line name	Point number	Point index	Point code	Static correction	Point depth
1		6006	6136	0	0	0.0
2		6007	6135	0	0	0.0
3		6007	6137	0	0	0.0
4		6008	6138	0	0	0.0
5		6011	6131	0	0	0.0
6		6012	6132	0	0	0.0
7		6012	6142	0	0	0.0
8		6013	6133	0	0	0.0
9		6013	6143	0	0	0.0
10		6014	6134	0	0	0.0
11		6014	6144	0	0	0.0
12		6015	6135	0	0	0.0
13		6015	6145	0	0	0.0
14		6016	6136	0	0	0.0
15		6016	6146	0	0	0.0
16		6017	6127	0	0	0.0
17		6017	6137	0	0	0.0
18		6017	6147	0	0	0.0
19		6017	6157	0	0	0.0
20		6018	6128	0	0	0.0
21		6018	6138	0	0	0.0
22		6018	6148	0	0	0.0
23		6018	6158	0	0	0.0

SPS Source Record: Spreadsheet Tab

The SPS Analyzer allows you to specify how the data will be read and decoded from this sps file. When the format is correctly defined, be sure to Save.

SPS Analyzer

Source Record identification

Record identification Start Col End Col

1 1 ☐ Read lines with source record ID "S" First line to read 1

	Start Col	End Col	Load	Minimum	Maximum		Start Col	End Col	Load	Minimum	Maximum
Source line	2	17	<input checked="" type="checkbox"/>	6006	6099	Source static	29	32	<input checked="" type="checkbox"/>	0	0
Source location	18	25	<input checked="" type="checkbox"/>	6002	6174	Source depth	33	36	<input checked="" type="checkbox"/>	0.0	0.0
Source index	26	26	<input checked="" type="checkbox"/>	0	0	Source datum	37	40	<input checked="" type="checkbox"/>	0	0
Source code	27	28	<input checked="" type="checkbox"/>			Source uphole	41	42	<input checked="" type="checkbox"/>	0	0
Source easting	47	55	<input checked="" type="checkbox"/>	788339.9	809248.6	Water depth	43	46	<input checked="" type="checkbox"/>	0.0	0.0
Source northing	56	65	<input checked="" type="checkbox"/>	939328.3	976916.1	Recording date	72	74	<input checked="" type="checkbox"/>	0	0
Source elevation	66	71	<input checked="" type="checkbox"/>	4934.3	5405.7	Recording time	75	80	<input checked="" type="checkbox"/>	0	0

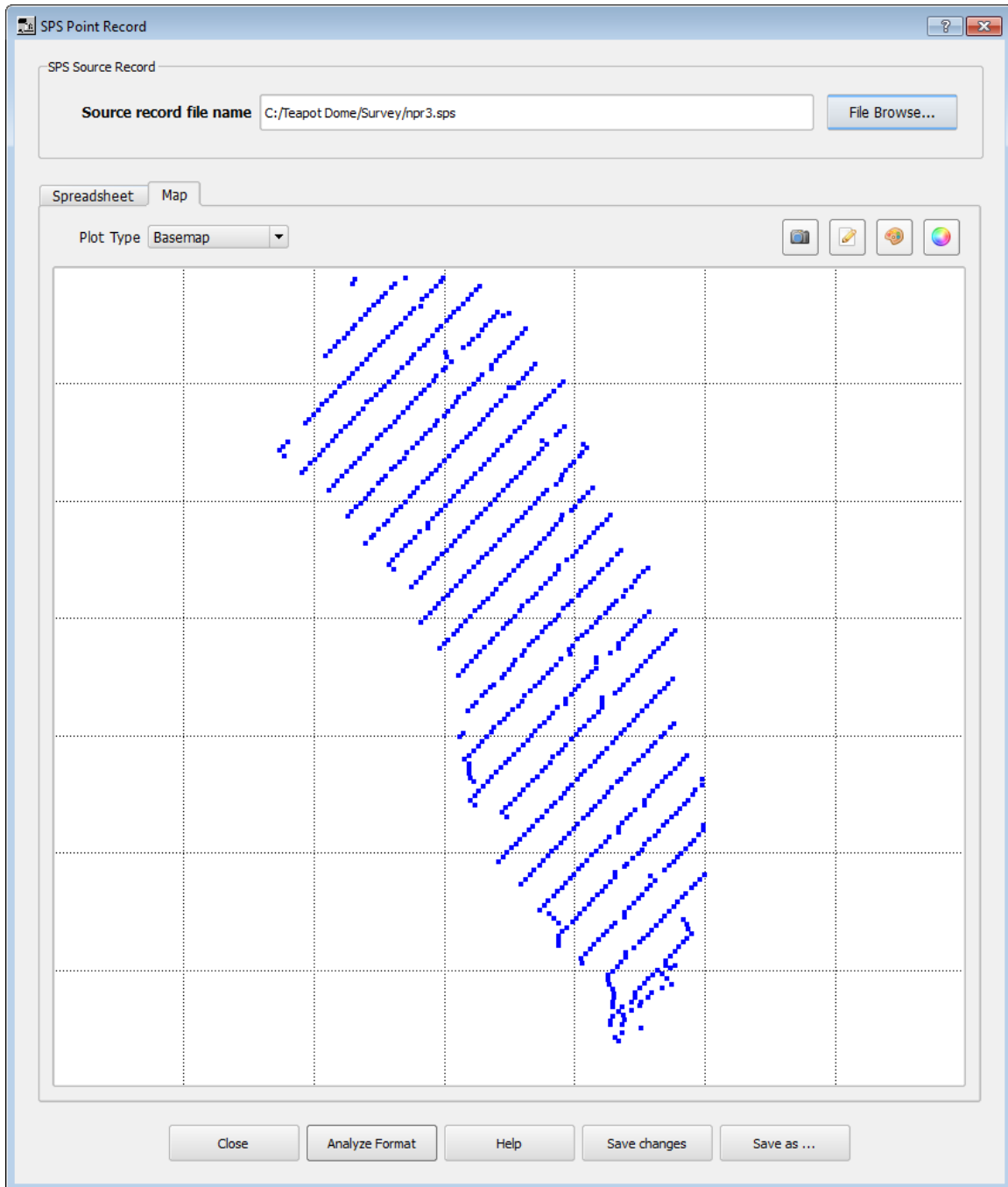
1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

6007	6135	788557.50968125.5005032.8
6006	6136	788339.90968428.3005034.7
6007	6137	788507.30968604.0005030.7
6008	6138	788721.80968829.7005025.7
6011	6131	789417.60967306.9004993.6
6012	6132	789618.20967516.7004987.3
6012	6142	789581.30969730.6005016.3
6013	6133	789848.30967755.4004992.0
6013	6143	789795.20969955.7005011.3
6014	6134	790061.30967981.0004993.0
6014	6144	790009.80970179.4005010.3
6015	6135	790276.90968207.8005013.7
6015	6145	790225.20970405.5005001.7
6016	6136	790491.40968430.5005000.0
6016	6146	790418.00970697.1005007.3
6017	6127	790757.90966457.4005039.0
6017	6137	790706.20968655.9004982.7
6017	6147	790655.00970855.9005008.6
6017	6157	790603.20973055.2005044.5
6018	6128	790973.10966681.6005042.1
6018	6138	790920.90968880.6004983.5
6018	6148	790869.10971080.4005003.5
6018	6158	790817.50973280.6005048.3
6019	6129	791187.20966906.8005060.7
6019	6139	791134.00969106.4004983.5
6019	6149	791064.40971284.9005006.8
6019	6159	791032.60973506.7005051.6
6020	6130	791402.70967131.6005080.5
6020	6140	791350.30969331.8004976.2
6020	6150	791208.60971530.0005006.7

Save Format Help Close

SPS Source Record: Record Analysis Tab

The SPS Point Record also has a tab for map display. The Map tab allows you to specify the Plot Type. The default is Basemap.



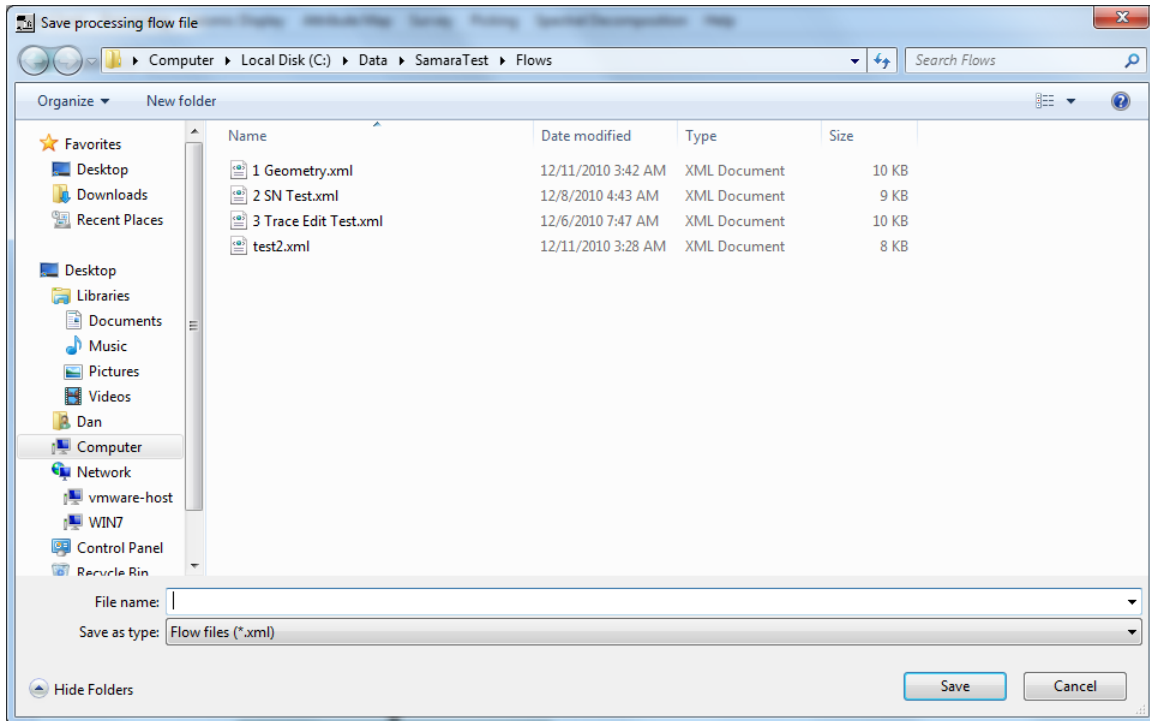
SPS Source Record: Basemap

Running the Flowchart

Once you are satisfied with the flow you have constructed, you need to name and execute the flow to complete your processing.

Naming and Saving a Flow

First, you must give the flow a name and save it. To name a flow document, use the Save... or the Save As... commands in the File menu. By default the flow will be saved into the project Flows directory. You will want to assign a meaningful name to the flow document. Flows are saved in XML format so you can view them with any text editor or web browser as well as opening the graphical view in SPW.

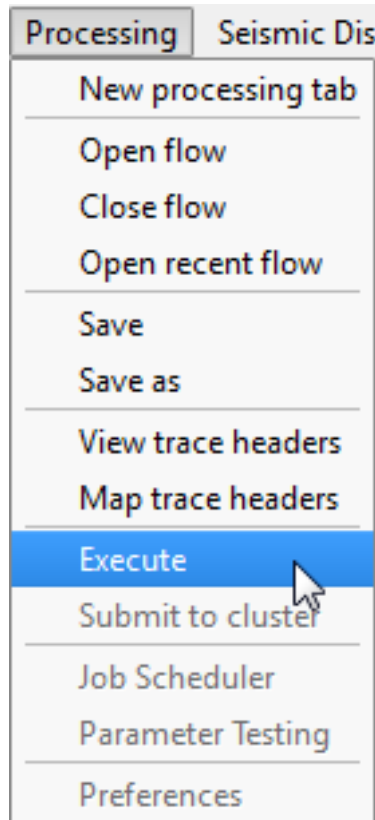


Save Flowchart XML File

If you try to compile a job that has not been named and saved, the Save as Flowchart dialog will automatically appear and you will be prompted to give the flow chart a name. If you do not give the flow chart a valid name and save it, then you will not be able to execute it.

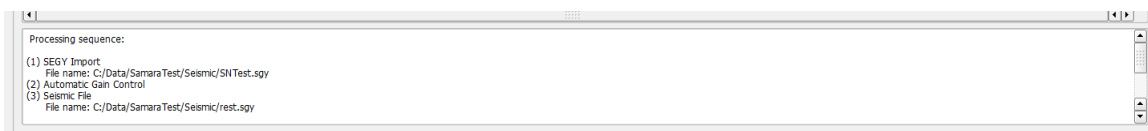
Executing a Flow inside the Flowchart

Running a flow is a simple matter of selecting a processing step on the flowchart and pressing the Execute button or selecting the Execute command from the Flowchart menu.



Execute Command

Below is a display of the console area at the bottom of the flowchart display. The console will show any errors or warnings. It also shows messages about the status of the job execution. The execution of the flow is done on a separate thread from the flowchart, seismic and map displays so you can continue working during a job execution.



Execution Console

Executing a Flow on a Cluster

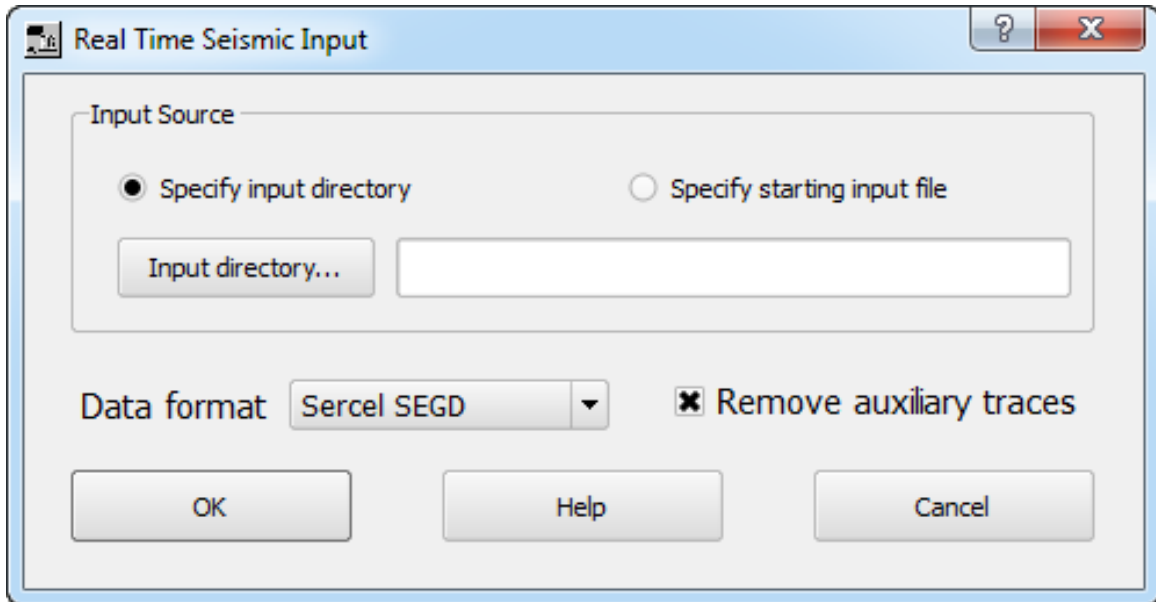
This feature is currently in testing .

Instantaneous Field QC Capabilities and Procedures

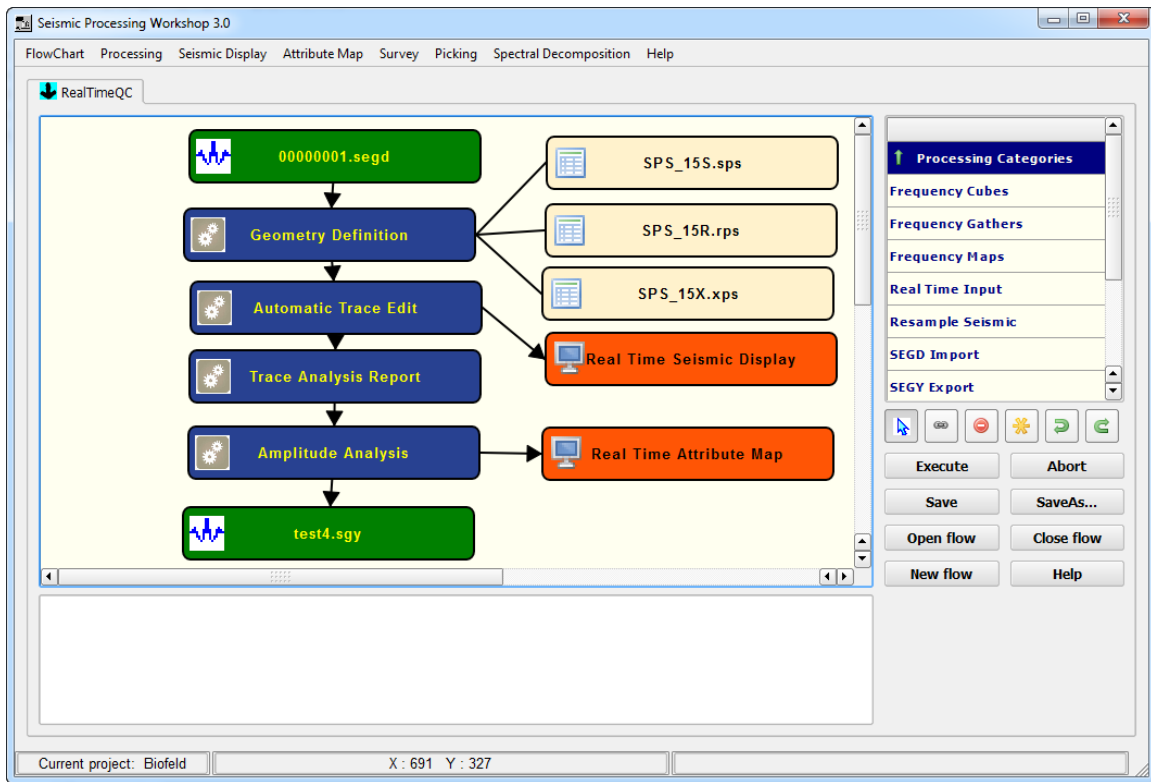
A focus of the development of this version of SPW has been to simplify and automate field quality control. Multiple new map displays have been implemented to enable rapid visualization of your survey. Real time input of data direct from seismic recorders has been incorporated and simplified. Real time displays of seismic data, attribute maps and survey information are some of the new capabilities.

Real Time Processing

Real time processing starts with the input from the seismic recorder. SPW currently supports ARAM SEG-Y format, Sercel SEG-D format, Hydroscience SEG-D format, Standard SEG-D format, and SEG2 format. Other formats and recording instrument specifications will be added as needed in the future. The implementations of these formats read in all of the extended headers and if the geometry information is present in the headers, it is always input.

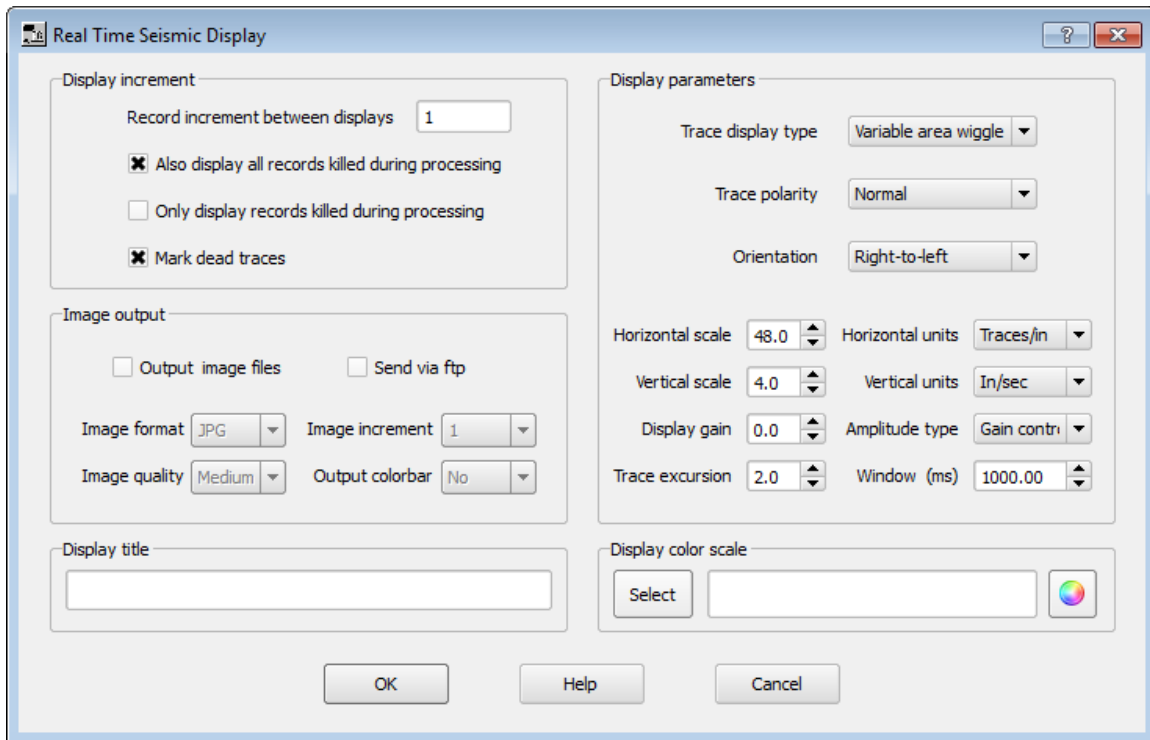


Real Time Seismic Input Dialog



A Simple Real Time Processing Flowchart

Real Time Seismic Displays



The dialog box is titled "Real Time Seismic Display" and contains several sections for configuring seismic data visualization.

Display increment

- Record increment between displays: 1
- ☒ Also display all records killed during processing
- ☐ Only display records killed during processing
- ☒ Mark dead traces

Image output

- ☐ Output image files
- ☐ Send via ftp
- Image format: JPG
- Image increment: 1
- Image quality: Medium
- Output colorbar: No

Display title

[Empty text field]

Display parameters

- Trace display type: Variable area wiggle
- Trace polarity: Normal
- Orientation: Right-to-left
- Horizontal scale: 48.0
- Horizontal units: Traces/in
- Vertical scale: 4.0
- Vertical units: In/sec
- Display gain: 0.0
- Amplitude type: Gain contr
- Trace excursion: 2.0
- Window (ms): 1000.00

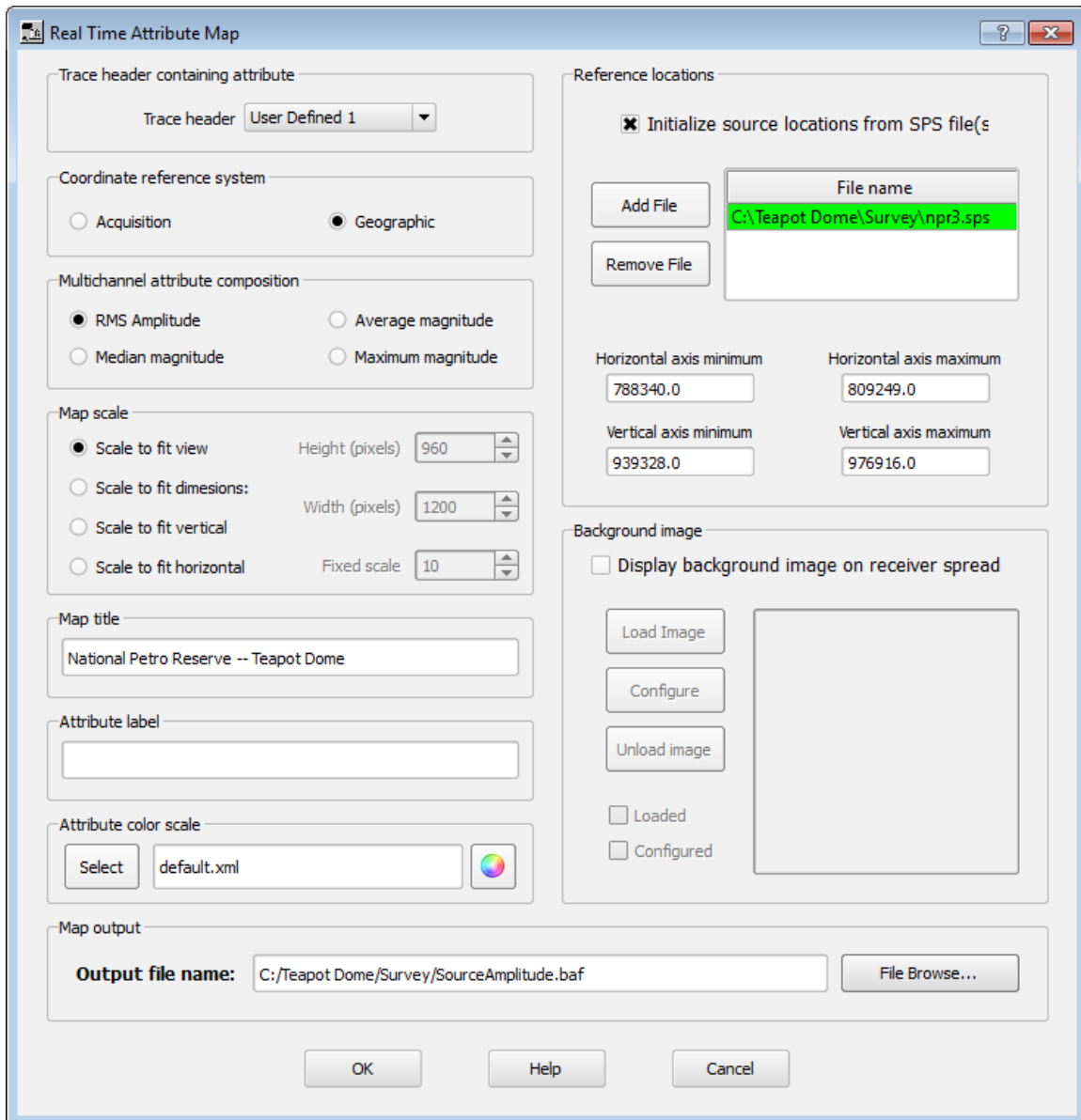
Display color scale

Select [Empty color scale field] [Color selection icon]

Buttons: OK, Help, Cancel

Real Time Seismic Display Dialog

Real Time Map Displays



The dialog box is titled "Real Time Attribute Map" and contains several sections for configuring the map display. The "Trace header containing attribute" section has a dropdown menu set to "User Defined 1". The "Coordinate reference system" section has two radio buttons: "Acquisition" and "Geographic", with "Geographic" selected. The "Multichannel attribute composition" section has four radio buttons: "RMS Amplitude", "Average magnitude", "Median magnitude", and "Maximum magnitude", with "RMS Amplitude" selected. The "Map scale" section has four radio buttons: "Scale to fit view", "Scale to fit dimesions:", "Scale to fit vertical", and "Scale to fit horizontal", with "Scale to fit view" selected. It also includes input fields for "Height (pixels)" (960), "Width (pixels)" (1200), and "Fixed scale" (10). The "Map title" section has a text field containing "National Petro Reserve -- Teapot Dome". The "Attribute label" section has an empty text field. The "Attribute color scale" section has a "Select" button, a text field containing "default.xml", and a color selection icon. The "Reference locations" section has a checkbox "Initialize source locations from SPS file(s)" which is checked. It includes "Add File" and "Remove File" buttons, and a list box showing "C:\Teapot Dome\Survey\npr3.sps". It also has input fields for "Horizontal axis minimum" (788340.0), "Horizontal axis maximum" (809249.0), "Vertical axis minimum" (939328.0), and "Vertical axis maximum" (976916.0). The "Background image" section has a checkbox "Display background image on receiver spread" which is unchecked. It includes "Load Image", "Configure", and "Unload image" buttons, and checkboxes for "Loaded" and "Configured". The "Map output" section has a text field for "Output file name:" containing "C:/Teapot Dome/Survey/SourceAmplitude.baf" and a "File Browse..." button. At the bottom are "OK", "Help", and "Cancel" buttons.

Real Time Attribute Map

Trace header containing attribute
Trace header: User Defined 1

Coordinate reference system
☐ Acquisition ☒ Geographic

Multichannel attribute composition
☒ RMS Amplitude ☐ Average magnitude
☐ Median magnitude ☐ Maximum magnitude

Map scale
☒ Scale to fit view Height (pixels): 960
☐ Scale to fit dimesions: Width (pixels): 1200
☐ Scale to fit vertical Fixed scale: 10
☐ Scale to fit horizontal

Map title
National Petro Reserve -- Teapot Dome

Attribute label

Attribute color scale
Select default.xml

Reference locations
☒ Initialize source locations from SPS file(s)
Add File Remove File
File name: C:\Teapot Dome\Survey\npr3.sps
Horizontal axis minimum: 788340.0 Horizontal axis maximum: 809249.0
Vertical axis minimum: 939328.0 Vertical axis maximum: 976916.0

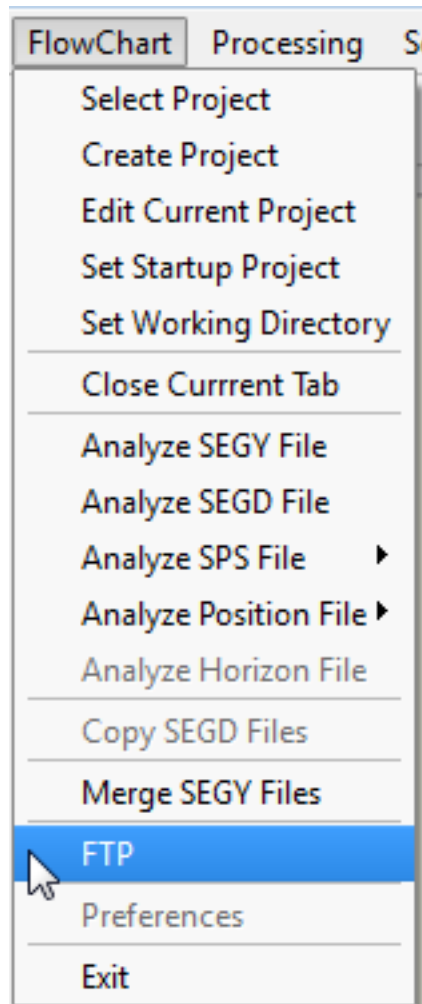
Background image
☐ Display background image on receiver spread
Load Image Configure Unload image
☐ Loaded ☐ Configured

Map output
Output file name: C:/Teapot Dome/Survey/SourceAmplitude.baf File Browse...

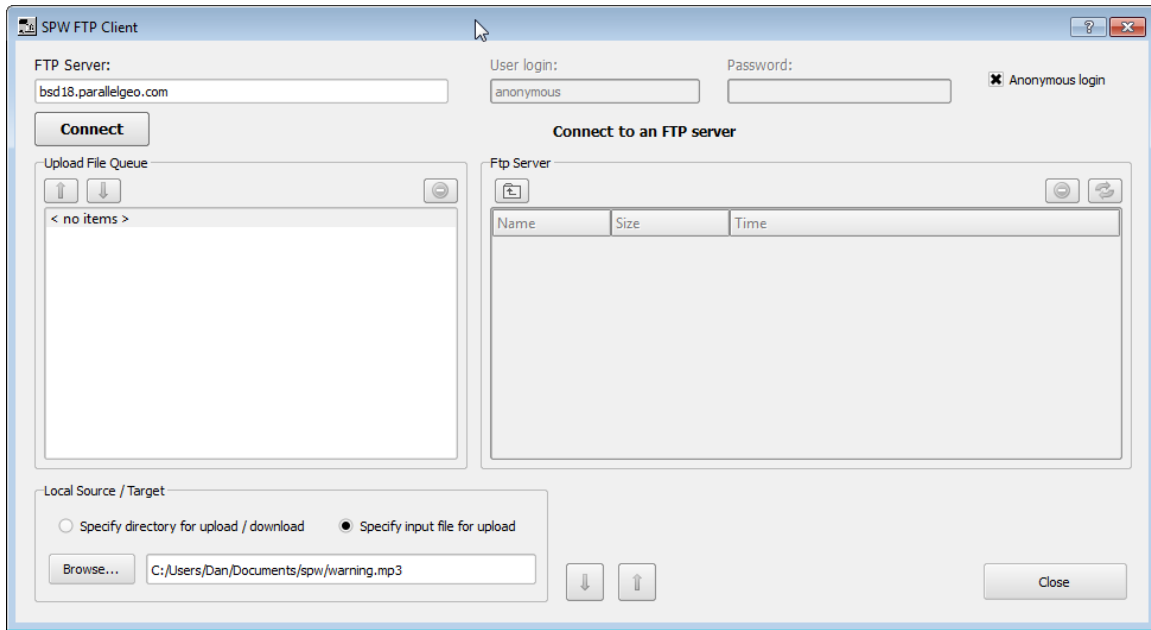
OK Help Cancel

Real Time Attribute Map Display Dialog

FTP Connection



Open the FTP Client



FTP Client Window

Using the SPW ftp client, either complete directories or single files may be sent to a ftp server. Simply open a connection to the ftp server and then select the directory or the files to transfer.

Sending Reports via FTP in Real Time

Several reports on record and trace kills may be sent automatically to a ftp server during the execution of a flow. This feature allows experienced personnel in the office to assist in evaluating noisy or problem data by being able to review the same information available to the field personnel. To enable this option, the ftp connection must be initiated using the ftp client from the Flowchart menu. After the connection is established then selecting the Sent file via ftp option will automatically send the report file after each record is processed.

Signal to Noise for Editing Records

Report file

File Browse... C:/Teapot Dome/Report/SignalToNoiseReport.txt

☒ Send file via ftp ☒ Append to existing file

Amplitude definition

☒ Average power ☐ Average absolute value
☐ Average RMS

Signal definition method

☒ Enter signal window ☐ Import signal window

Noise definition method

☒ Enter noise window ☐ Import noise window

Spatial application

☒ Apply to all data
☐ Reference Exclusion Zone file

☐ Apply inside exclusion zones
☒ Apply outside exclusion zones

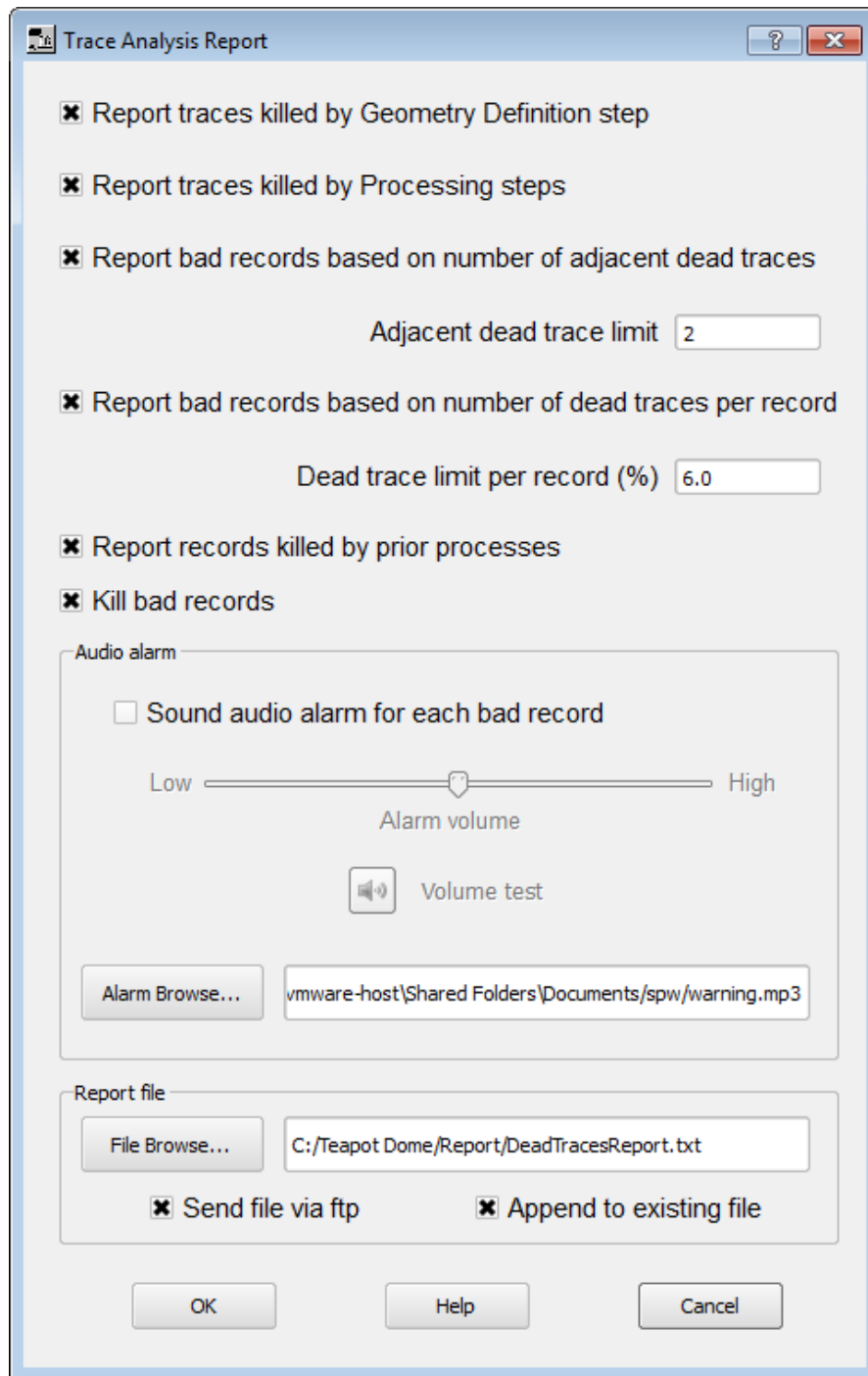
Record edit criteria

☒ Fails all windows ☐ Fails any window

Ratio	Signal Start time (ms)	Signal End time (ms)	Signal Start Offset	Signal End Offset	Noise Start time (ms)	Noise End time (ms)	Noise Start Offset	Noise End Offset	S/N Minimum	S/N Output header
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	None

Add Window Delete Window View Window Export Window Minimum live traces per analysis window 5 OK Help Cancel


Signal to Noise for Killing Records

The image shows a software window titled "Trace Analysis Report". It contains several sections for configuring report generation and alarms. The "Audio alarm" section includes a checkbox for "Sound audio alarm for each bad record", a volume slider set to the middle, and a "Volume test" button. The "Report file" section includes a "File Browse..." button, a text field with the path "C:/Teapot Dome/Report/DeadTracesReport.txt", and checkboxes for "Send file via ftp" and "Append to existing file". At the bottom are "OK", "Help", and "Cancel" buttons.

Trace Analysis Report

- ☒ Report traces killed by Geometry Definition step
- ☒ Report traces killed by Processing steps
- ☒ Report bad records based on number of adjacent dead traces
 - Adjacent dead trace limit:
- ☒ Report bad records based on number of dead traces per record
 - Dead trace limit per record (%):
- ☒ Report records killed by prior processes
- ☒ Kill bad records

Audio alarm

- ☐ Sound audio alarm for each bad record
- Low High
Alarm volume
-  Volume test
- Alarm Browse...

Report file

- File Browse...
- ☒ Send file via ftp ☒ Append to existing file

OK Help Cancel

Send Trace Analysis Report via FTP

Sending Image Files via FTP in Real Time

The Processing Library:

Overview

The library of processing steps is separated into categories. The categories are as follows:

Amplitude Adjustment
Auxiliary Data A-P
Auxiliary Data R-Z
Display
Editing
Filtering
Geometry
Migration
Multi-component
Mutes
Quality Analysis
Seismic Data
Spectral Attributes
Spectral Decomposition
Stacking/Summing
Statics
Trace Attributes
User Plugins
Velocities
Vsp
Wavelet Shaping

Not all processing steps from SPW 2 are available in SPW 3.

The standard use of each processing step will be described in the pages that follow. If the step is enabled for only 2-D or only 3-D, it will be explicitly annotated as such; otherwise the process may be used with both 2-D and 3-D data. Each of the Processing Step descriptions lists the mandatory and optional input and output links required for execution, and contains an illustration of an example flow chart. References are given for some processing steps based upon specific published techniques or algorithms. An image of the processing step's parameter dialog is also displayed for your reference. Finally, you will find a description of each parameter for each processing step. At the end of each parameter description, the valid range for each parameter is shown in brackets {}.

Abbreviations for the parameters are as follows –

- - Greater than
- <= - Less than or equal to
- < - Less than
- >= - Greater than or equal to
- #,# - Range of values from first number to last number

Parameter range checking is enabled for some of the processing step parameters. Additional parameter range checking will be enabled in the future.

Note: For processing parameters with spatial units such as feet, meters, feet per second, meters per second, etc., SPW assumes that you are consistent in your use of spatial units for the entire data set. If your geometry information is in meters then you should consistently use metric units as your unit of measure for the SPW processing parameters applied to that data set. If your geometry information is in feet then you should consistently use English units as your unit of measure for the SPW processing parameters applied to that data set. Combining English and metric units of measure when processing in SPW will yield erroneous results.

Amplitude Adjustment Steps

This section documents the processing steps available for Amplitude Adjustment.

Processing steps currently available are:

Processing Categories	
↑	Amplitude Equalization
	Apply Gain
	Automatic Gain Control
	Clip
	Random Noise
	Spherical Divergence
	Trace Header Amplitude Math
	Windowed Trace Balance

Amplitude Equalization

Usage:

The Amplitude Equalization step allows you to balance the RMS values of your data traces to a constant specified RMS level. You can also clip your data at a specified level. You can specify the data window to use in calculating the RMS amplitudes, the output RMS and clipping levels, and the method of amplitude equalization, which may be either trace constant or record constant.

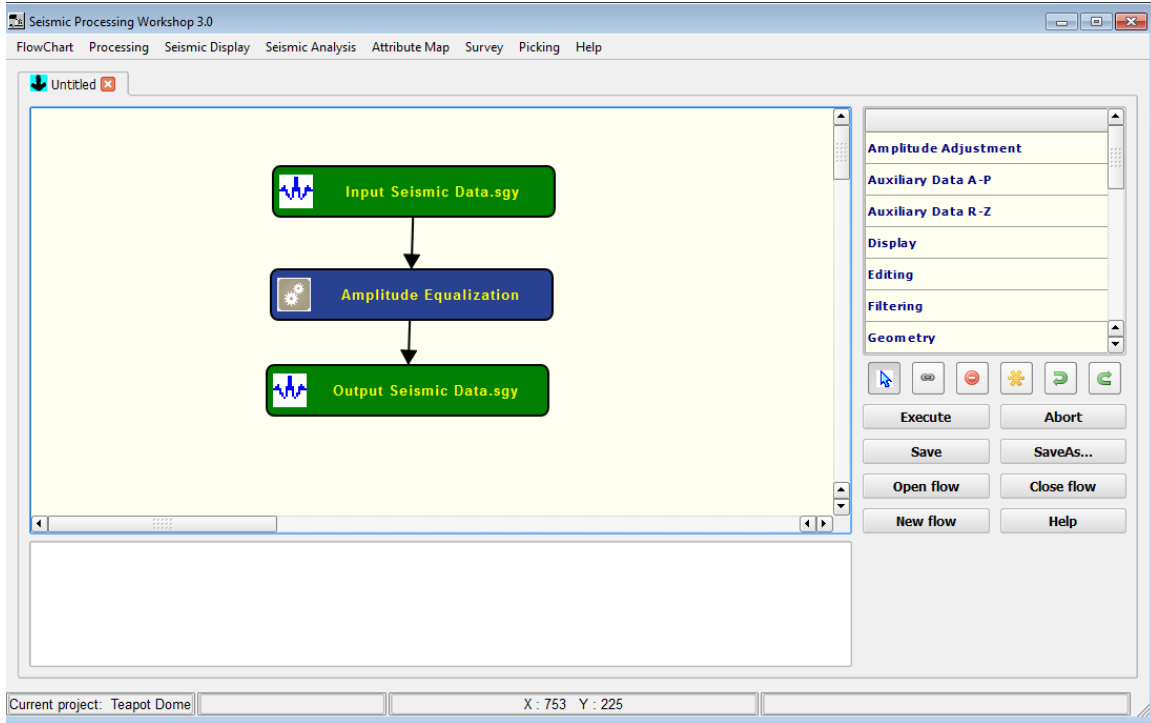
Input Links:

- 1) Seismic data in any sort order (mandatory).

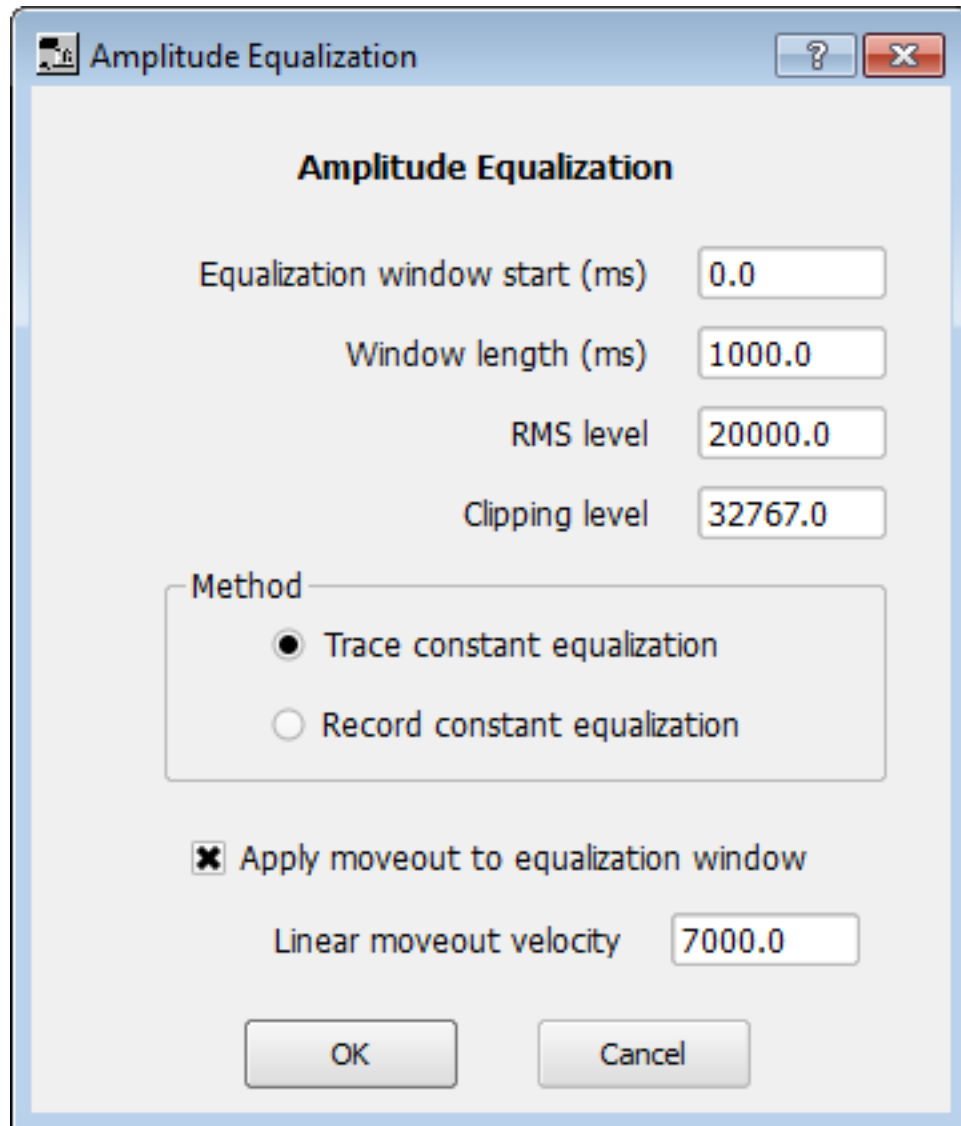
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Amplitude Equalization". It contains several input fields and checkboxes. The "Equalization window start (ms)" is set to 0.0, "Window length (ms)" is 1000.0, "RMS level" is 20000.0, and "Clipping level" is 32767.0. Under the "Method" section, "Trace constant equalization" is selected with a radio button, while "Record constant equalization" is unselected. The checkbox "Apply moveout to equalization window" is checked. The "Linear moveout velocity" is set to 7000.0. At the bottom are "OK" and "Cancel" buttons.

Parameter	Value
Equalization window start (ms)	0.0
Window length (ms)	1000.0
RMS level	20000.0
Clipping level	32767.0
Method	Trace constant equalization
Apply moveout to equalization window	Yes
Linear moveout velocity	7000.0

Parameter Description:

Equalization window start (ms) — Enter the start time in milliseconds of the window to be used in calculating the trace amplitude. {>=0}

Window length (ms) — Enter the length in milliseconds of the window to be used in calculating the trace amplitude. {>0.0}

RMS level — Enter the output RMS level of the data window specified. {>0.0}

Clipping level — Enter the clipping level of the trace data. {>0.0}

Method — Select whether to apply the equalization on a trace by trace basis or to maintain relative amplitudes and level the RMS value of the entire record.

Trace constant — If selected, your data will be equalized on a trace by trace basis.

Record constant — If selected, your data will be equalized on a record by record basis, which will depend on the sort order of the input data.

Apply moveout window — If checked, the equalization will be performed after linear moveout at the specified velocity. The window start time will shift by: $\text{delta time} = \text{offset/velocity}$.

Linear moveout velocity — Enter the constant moveout velocity. {>0.0}

Apply Gain

Usage:

The Apply Gain step allows you to apply gain function curves to your seismic data. The gain curves are specified as time – dB pairs and are linearly interpolated to each location along the line. A constant gain multiplier may also be applied to the data.

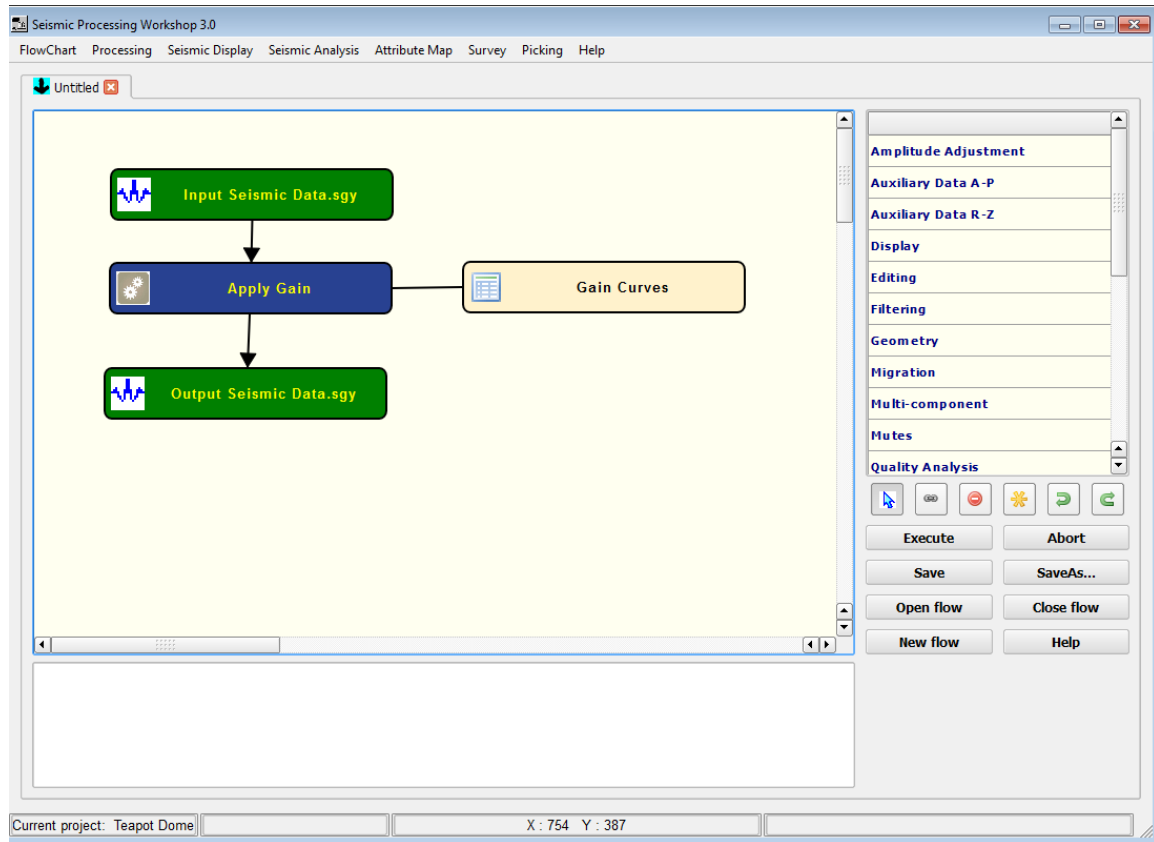
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Gain Curves cards (optional).

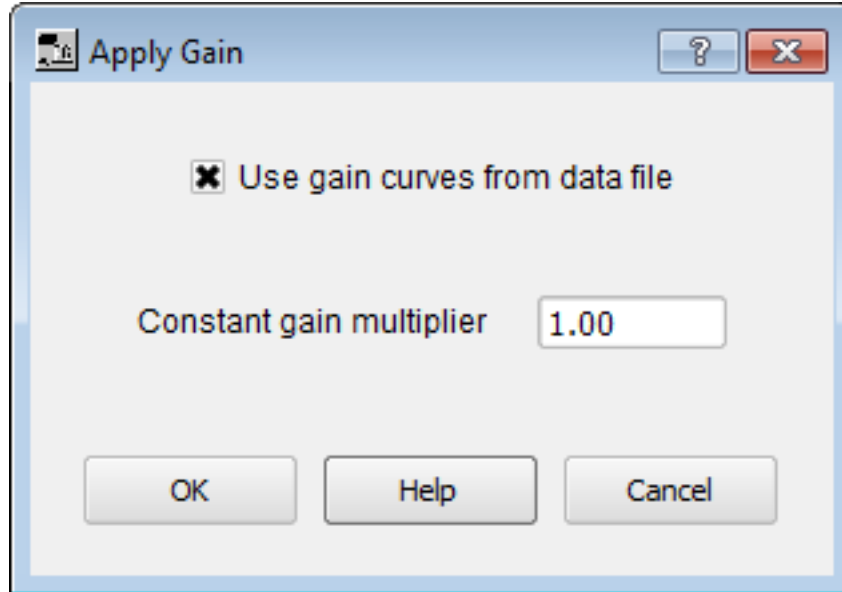
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

Example Flow chart:



Step Parameter Dialog:



Parameter Description:

Use gain curves from data file — An input auxiliary gain spreadsheet will be used and the gain curves in this data file will be applied to the seismic data.

Constant gain multiplier — Each trace data sample is multiplied by this constant value.

Automatic Gain Control

Usage:

The Automatic Gain Control step allows you to apply up to five sliding window gain functions to each data trace. You specify the number of gated windows, the overlap between the gated windows, and the start time and length of each gate. The calculated gain functions may be output to an optional seismic file, which allows you the option to remove the AGC functions prior to subsequent processing steps.

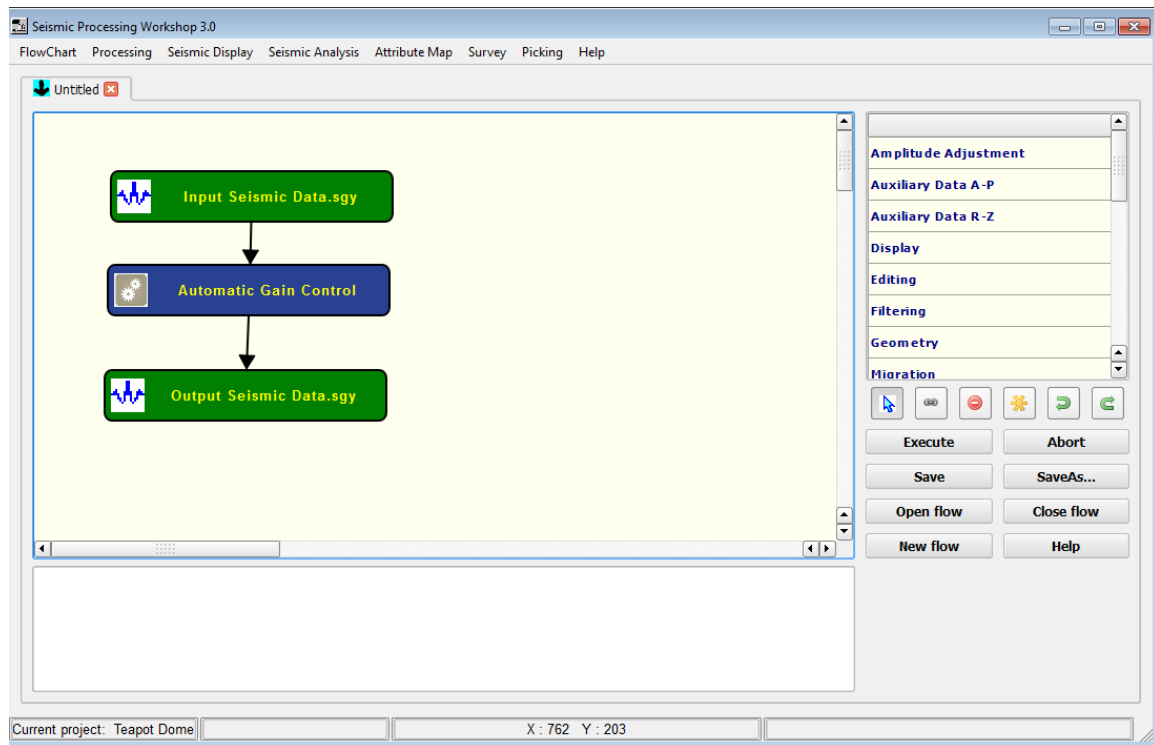
Input Links:

1) Seismic data in any sort order (mandatory).

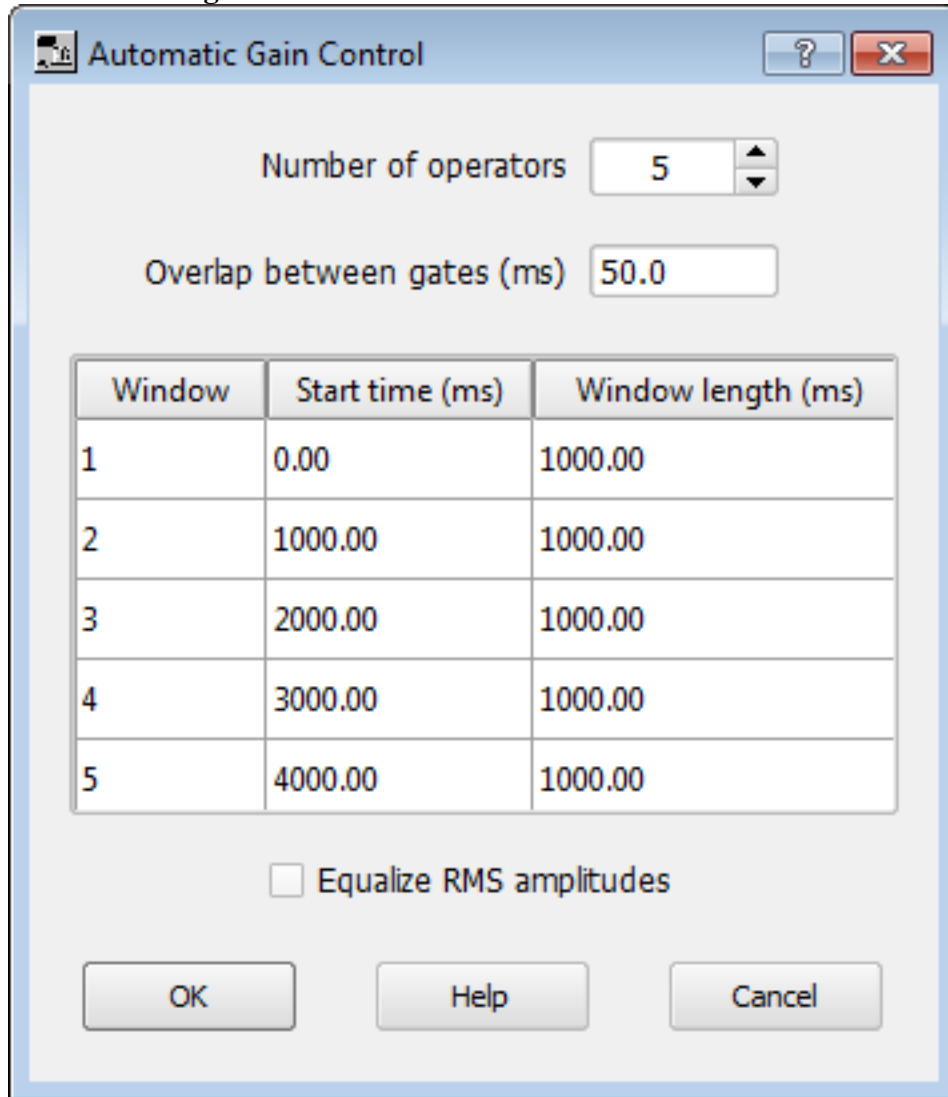
Output Links:

1) Seismic data in same sort order as input (mandatory).

Example Flowcharts:



Step Parameter Dialog:



The dialog box is titled "Automatic Gain Control" and contains the following controls:

- Number of operators:** A numeric spinner set to 5.
- Overlap between gates (ms):** A text input field containing 50.0.
- Table:** A table with 3 columns: Window, Start time (ms), and Window length (ms). It contains 5 rows of data.
- Equalize RMS amplitudes:** An unchecked checkbox.
- Buttons:** OK, Help, and Cancel buttons at the bottom.

Window	Start time (ms)	Window length (ms)
1	0.00	1000.00
2	1000.00	1000.00
3	2000.00	1000.00
4	3000.00	1000.00
5	4000.00	1000.00

Parameter Description:

Number of operators — Enter the number of operators to design and apply on each trace. Each trace will be divided into this number of time gates (windows). {1,5}

Overlap between gates (ms) — Enter the overlap between gates in milliseconds. Longer overlap between gates results in a smoother transition between the gated windows. {=>0}

Start Time (ms) — Enter the start time in milliseconds for each gate. {=>0.0}

Length (ms) — Enter the operator length in milliseconds for each gate. {=>0.0}

Equalize RMS amplitudes — If checked, the trace RMS amplitude prior to AGC and after AGC will be the same.

Clip

Usage:

The Clip step is used to remove high-amplitude sample values from the input data and replace them with a user supplied threshold sample value. The largest positive and largest negative acceptable sample amplitudes are provided by the user. Values outside of this range are replaced by the threshold value.

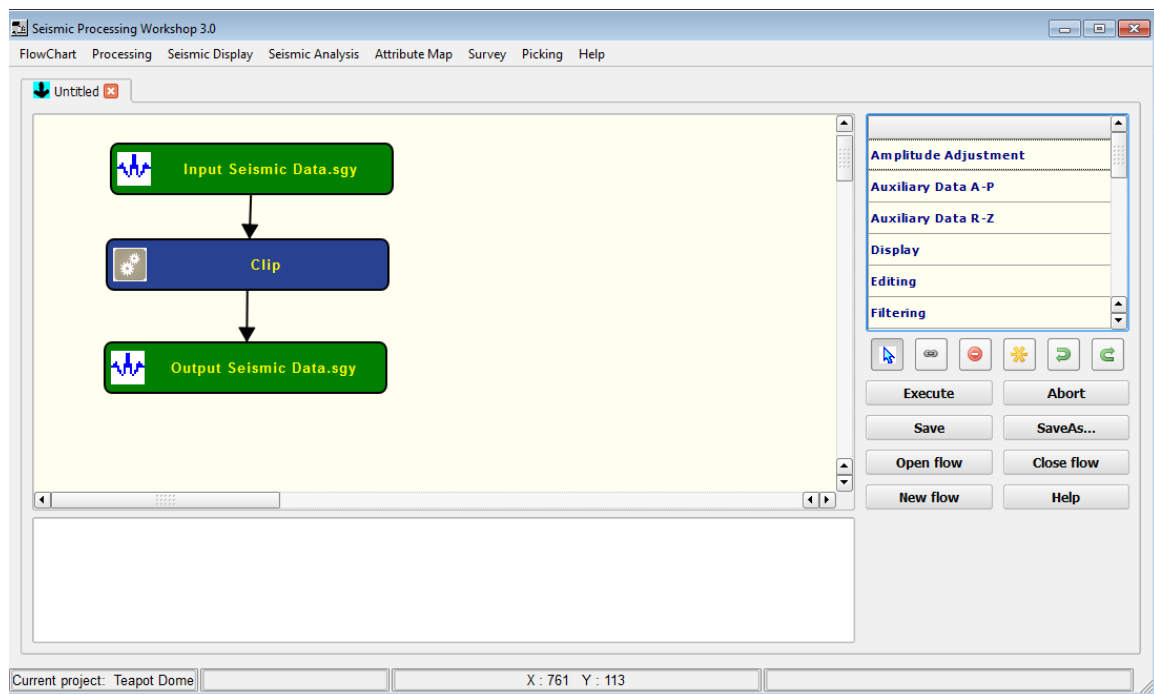
Input Links:

1) Seismic data in any sort order (mandatory).

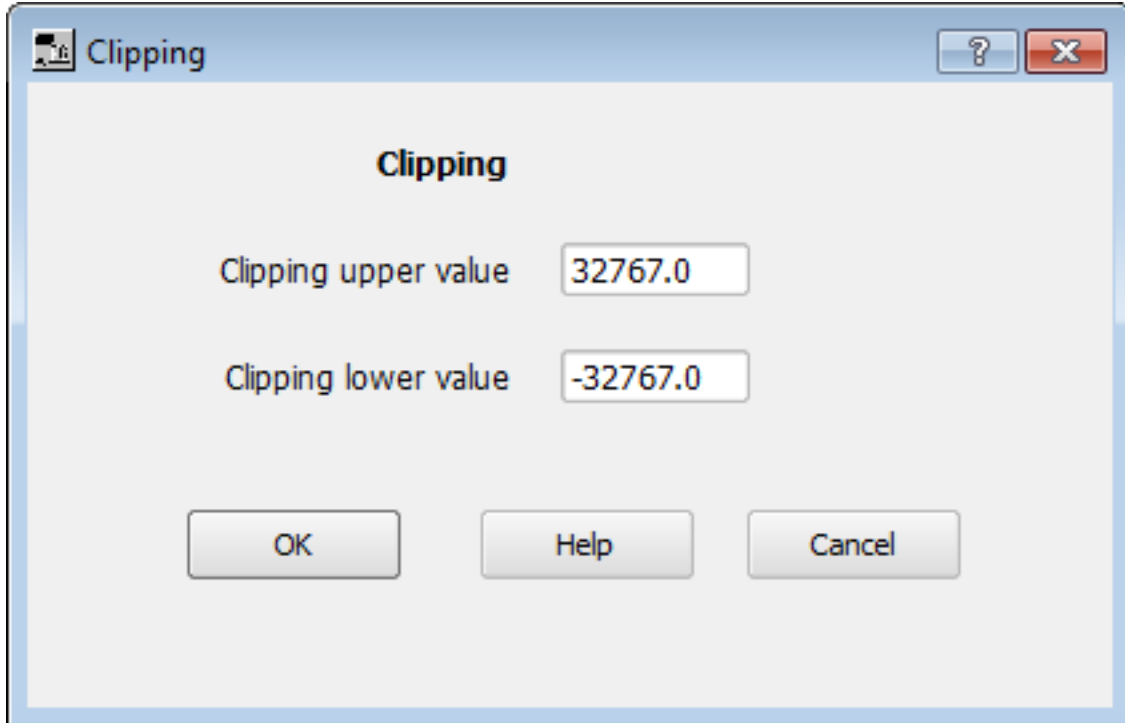
Output Links:

1) Seismic data in same sort order as input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Clipping upper value — Specify the largest acceptable positive value. Positive values larger than the clipping upper limit are replaced with the clipping upper limit.

Clipping lower value — Specify the largest acceptable negative value. Negative values greater than the clipping lower limit are replaced with the clipping lower limit.

Random Noise

Usage:

The Random Noise step allows you to ...

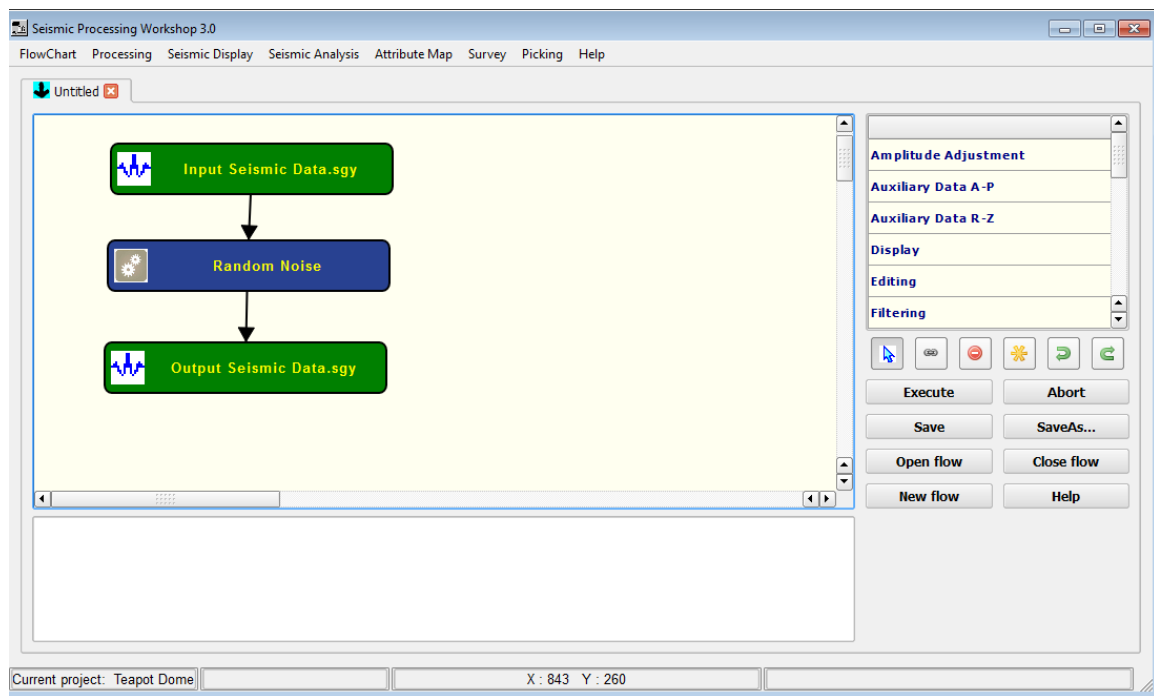
Input Links:

1) Seismic data in any sort order (mandatory).

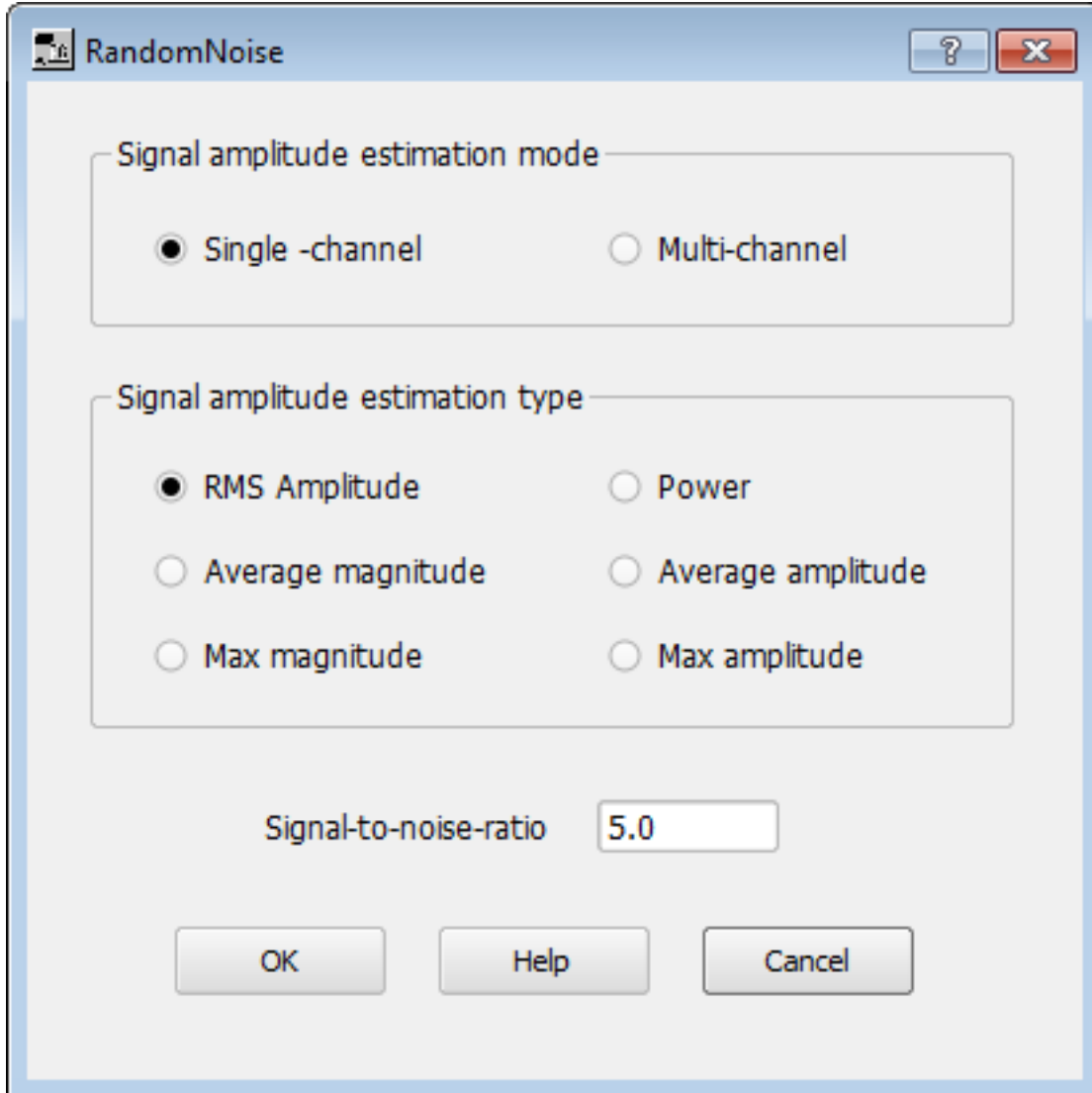
Output Links:

1) Seismic data in same sort order as input (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "RandomNoise". It has a standard title bar with a question mark icon and a close button (X). The dialog contains two grouped sections for parameter selection. The first section, "Signal amplitude estimation mode", has two radio buttons: "Single -channel" (selected) and "Multi-channel". The second section, "Signal amplitude estimation type", has six radio buttons arranged in three rows: "RMS Amplitude" (selected), "Power", "Average magnitude", "Average amplitude", "Max magnitude", and "Max amplitude". Below these sections is a text input field labeled "Signal-to-noise-ratio" with the value "5.0" entered. At the bottom are three buttons: "OK", "Help", and "Cancel".

RandomNoise

Signal amplitude estimation mode

☒ Single -channel ☐ Multi-channel

Signal amplitude estimation type

☒ RMS Amplitude ☐ Power

☐ Average magnitude ☐ Average amplitude

☐ Max magnitude ☐ Max amplitude

Signal-to-noise-ratio 5.0

OK Help Cancel

Parameter Description:

Signal amplitude estimation mode — Select single channel of multi channel.

Signal amplitude estimation type — Select ...

Signal-to-noise ratio — Enter the desired signal to noise ratio.

Spherical Divergence Correction

Usage:

The spherical divergence correction is designed to compensate for the decrease in seismic amplitude as a wavefront propagates away from the source location. The Spherical Divergence Correction step allows you to apply a gain to the data traces based on the equation:

$$\text{Gain} = T_Multiplier * (\text{Time} ** T_Exponent) * V_Multiplier * (\text{Velocity}(\text{Time}) ** V_Exponent).$$

The T_Multiplier and the V_Multiplier are constant gain factors and the T_Exponent and the V_Exponent vary the gain with time. Multipliers of one (1) and an exponents of two (2) are commonly used for the spherical divergence correction since energy from a point source dissipates in proportion to the square of distance traveled. To apply the spherical divergence correction as a function of both time and velocity, you must supply the optional velocity function. Otherwise, the velocity terms in the above equation will be ignored and the spherical divergence correction will only be applied as a function of time. You also have the option to apply the inverse spherical divergence correction function to your data.

Input Links:

1) Seismic data in any sort order (mandatory).

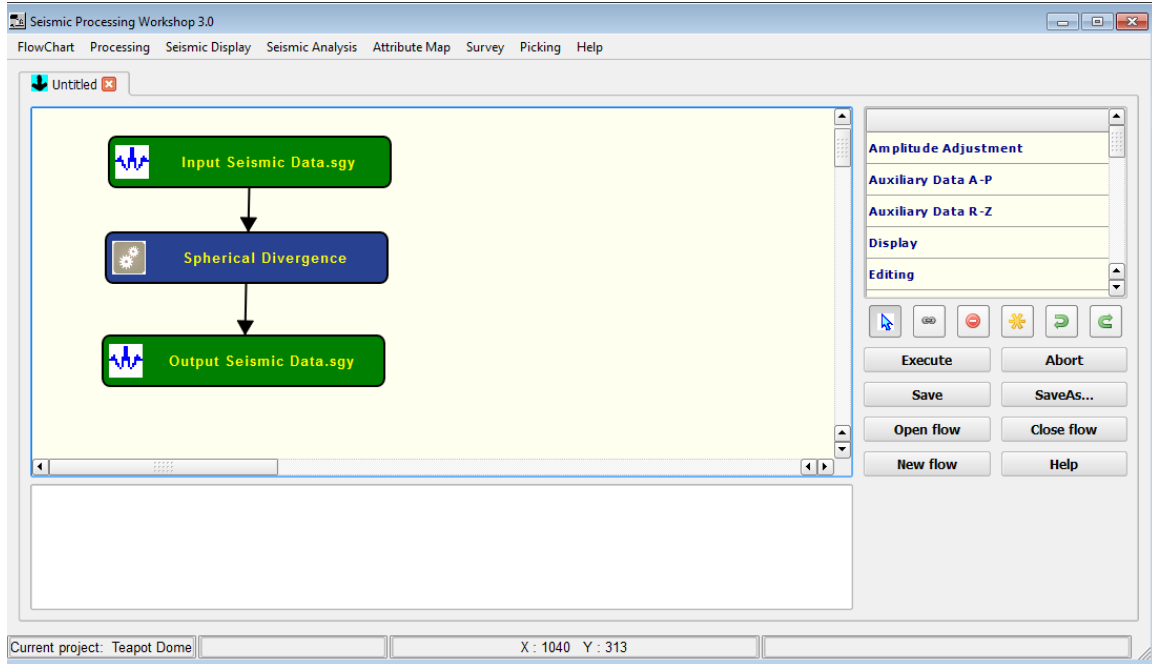
Output Links:

1) Seismic data in same sort order as input (mandatory).

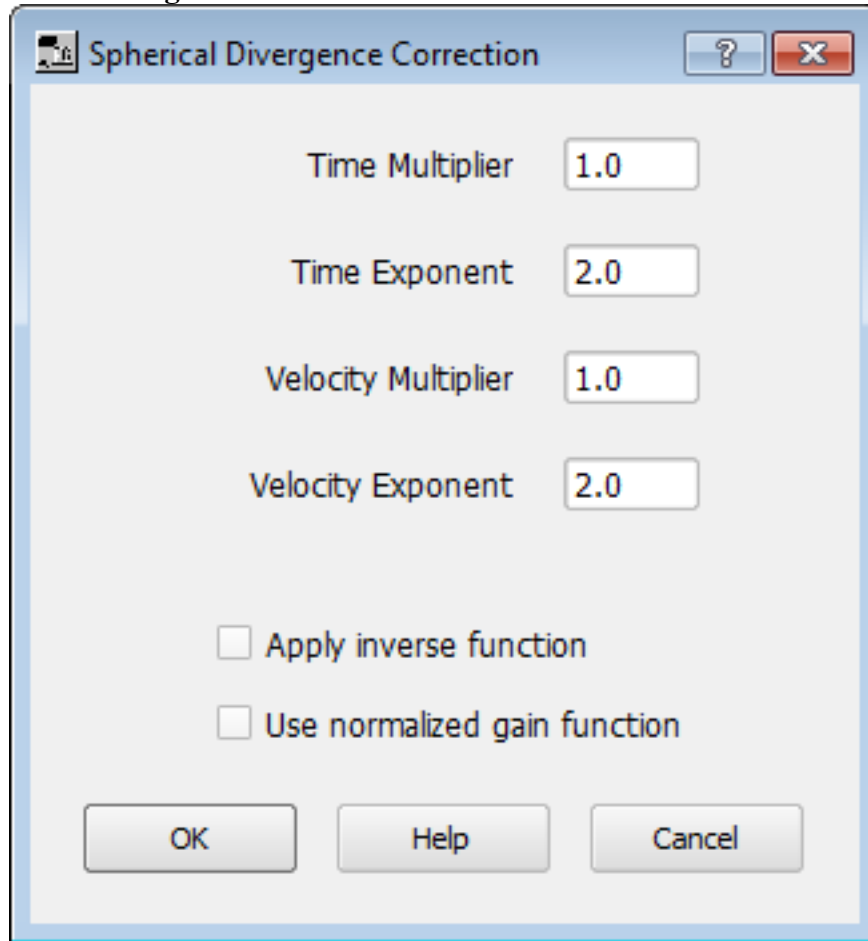
Reference:

Claerbout, Jon F., 1985, Fundamentals of Geophysical Data Processing: Blackwell Scientific Publications.

Example Flowcharts:



Step Parameter Dialog:



The image shows a software dialog box titled "Spherical Divergence Correction". It features a standard Windows-style title bar with a help icon (question mark) and a close icon (X). The main area contains four labeled input fields, each with a numerical value: "Time Multiplier" (1.0), "Time Exponent" (2.0), "Velocity Multiplier" (1.0), and "Velocity Exponent" (2.0). Below these fields are two unchecked checkboxes: "Apply inverse function" and "Use normalized gain function". At the bottom of the dialog are three buttons: "OK", "Help", and "Cancel".

Parameter Description:

The Gain equation for the following definitions is:

$$\text{Gain} = T_Multiplier * (\text{Time} ** T_Exponent) * V_Multiplier * (\text{Velocity}(\text{Time}) ** V_Exponent).$$

Time Multiplier — Enter the time multiplier in the gain equation.

Time Exponent — Enter the time exponent in the gain equation.

Velocity Multiplier — Enter the velocity multiplier in the gain equation.

Velocity Exponent — Enter the velocity exponent in the gain equation.

Apply inverse function — If checked, an inverse spherical divergence correction will be applied to your data.

Use normalize gain function — Normalize the gain function to be applied.

Trace Header Amplitude Math

Usage:

The Trace Header Amplitude Math step use used to modify sample values using mathematical operations on trace header fields. Any of the trace header fields can be used.

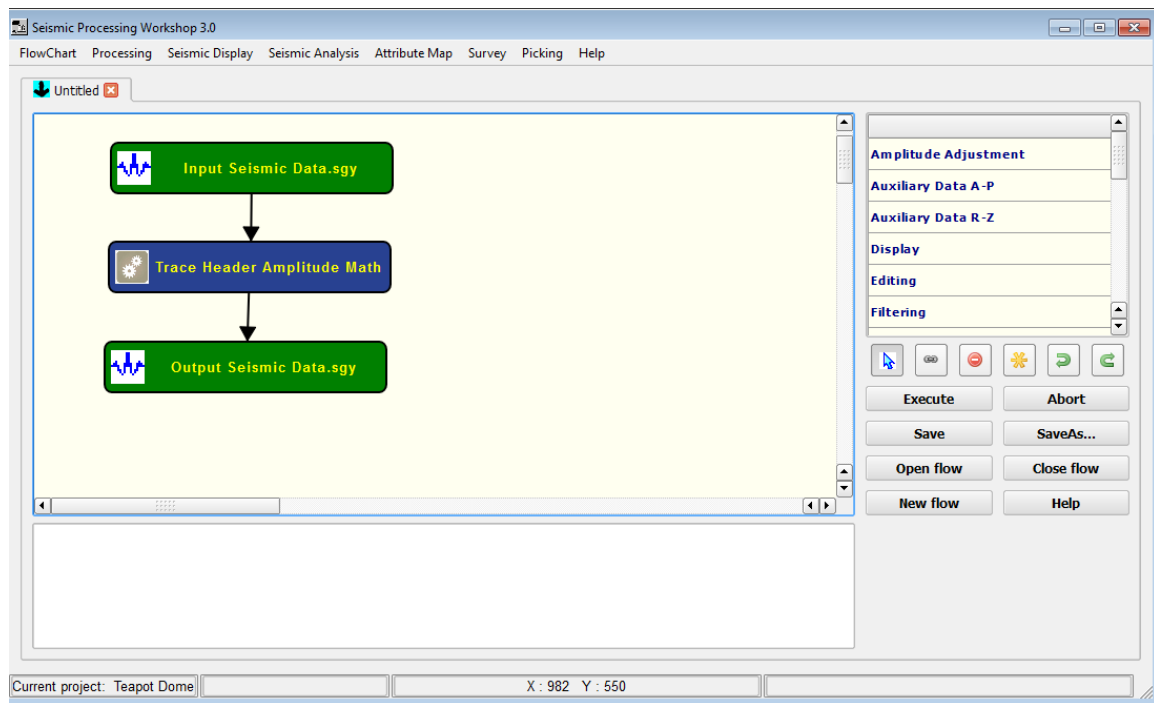
Input Links:

1) Seismic data in any sort order (mandatory).

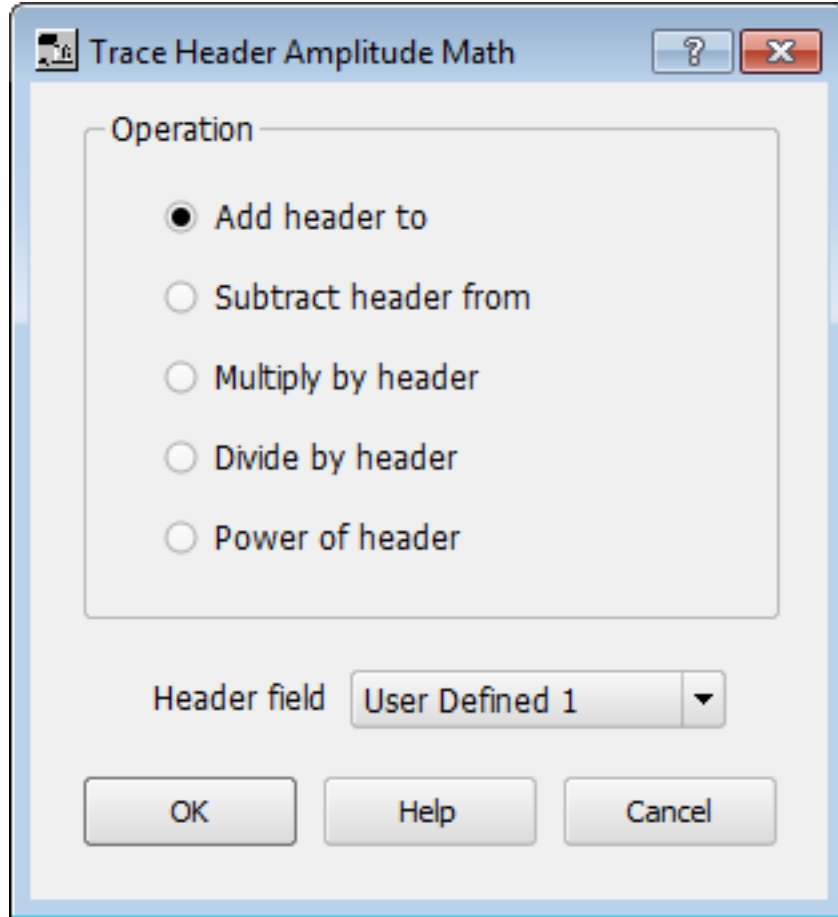
Output Links:

1) Seismic data in same sort order as input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Type of operator — Select the mathematical operation that will modify the seismic amplitude values.

Header Field — Select the trace header field that will modify the seismic amplitude values.

Example: If the Multiply by header operator is selected and the Header field is set to offset, then the sample values in each input trace will be multiplied by the value of offset in the corresponding trace header.

Windowed Trace Balance

Usage:

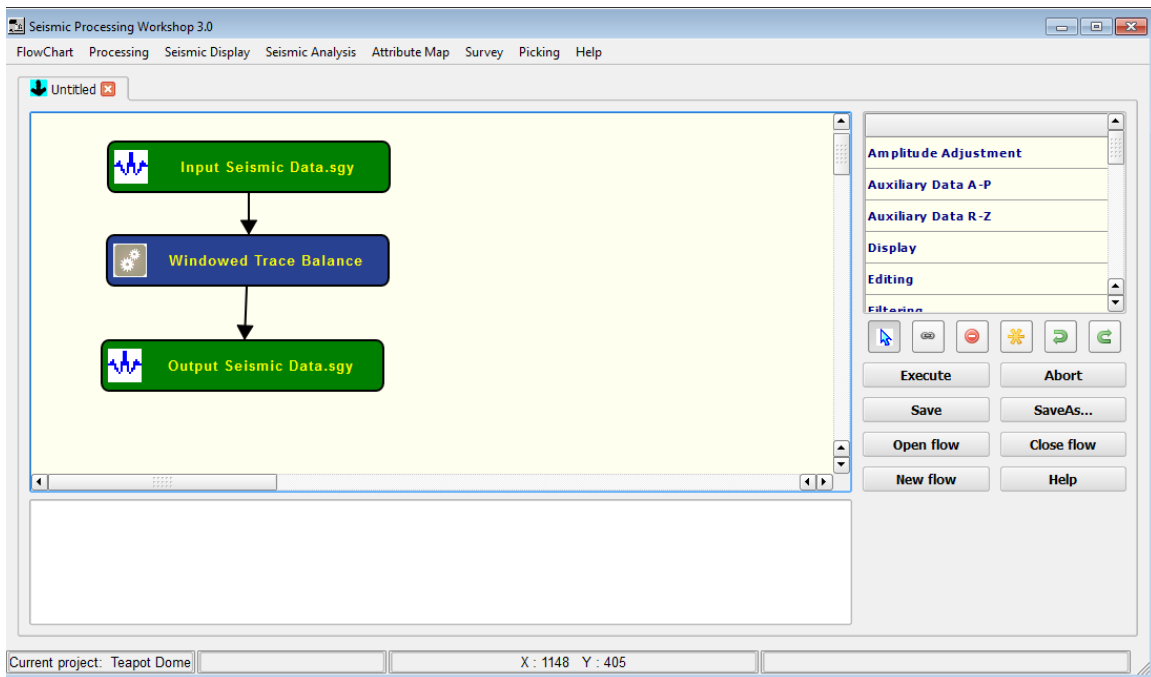
Input Links:

- 1) Seismic data in any sort order (mandatory).

Output Links:

- 1) Seismic data in same sort order as input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Number of windows per trace: 3

Reference Type:

☒ RMS Amplitude ☐ Mean Amplitude

Window	Window start (ms)	Window length (ms)	Reference level
1	0.00	500.00	5000.00
2	500.00	500.00	5000.00
3	1000.00	500.00	5000.00

OK Help Cancel

Parameter Description:

Reference type – Select whether the traces will be leveled according to RMS or mean amplitude.

Number of windows per trace — Enter the number of balancing windows per data trace.

Start (ms) — Enter the start time in milliseconds for the balancing window.

Length (ms) — Enter the length in milliseconds for the balancing window. The window will extend from the start time to start time + length.

Reference level — Enter the reference level for the balancing window. On output, the RMS or mean amplitude of the data trace will be equal to the specified value.

Auxiliary Data Steps

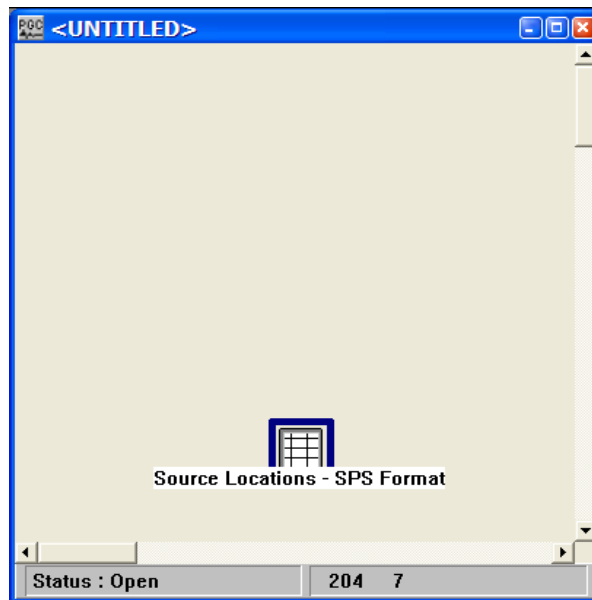
This section documents the support information available as Auxiliary Data. Auxiliary data may be imported from foreign data formats or output as foreign data formats. Auxiliary Data items currently available are:

Processing Categories	
	CMP Statics
	Crooked Line Bin Definition
	Early Mutes
	Exclusion Zones
	FK Mutes
	First Break Time Picks
	Frequency Filter
	Gain Curves
	Horizon File
	Line Definition File
	Multicomponent Receiver Statics
	PP NHMO Eta Function
	PP NHMO Gamma Function
	Phase Matching Statistics
	Polygon Definition
	Profile Geometry File

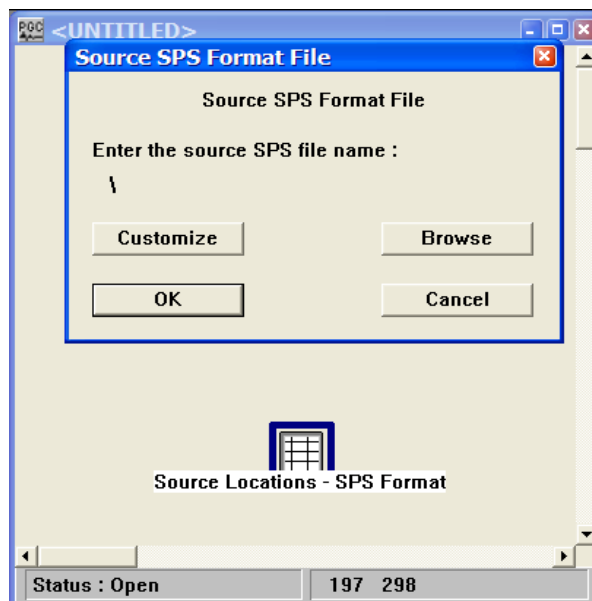
Receiver Gains
Receiver Statics
Receiver Statics List
Refractor Velocities
Residual NMO Analysis
Rotations File
SPS Observer Notes
SPS Receiver Locations
SPS Source Locations
Source Gains
Source Statics
Source Statics List
Streamer Definition
Surgical Mutes
Tail Mutes
Time Filter
Trace Kills
Trace Reversals
Trace Statics
UK00A P1 90
Velocity Function
Window Definition

Creating and Editing Auxiliary Data Files

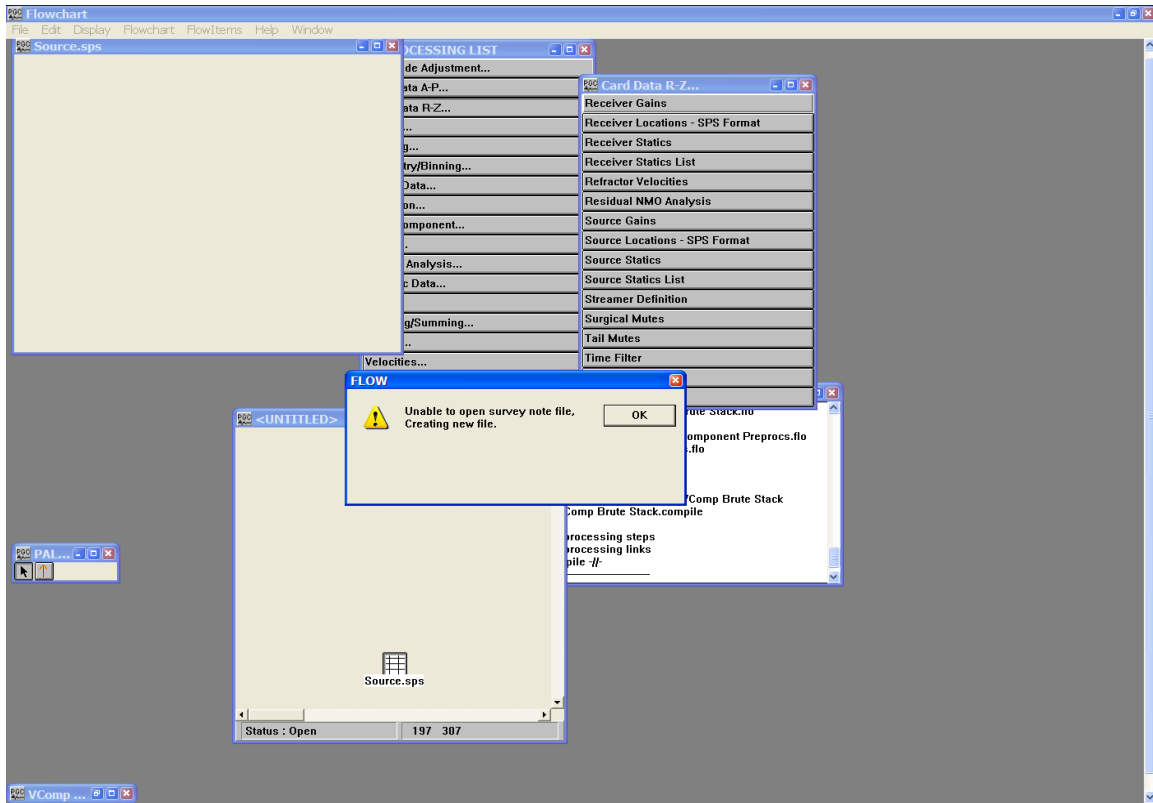
Each of the auxiliary data types can be created and edited manually within Flowchart. To create a card data file, select the appropriate icon from the card data list and place that icon on the Flowchart canvas. To add information to the card data file, you must first assign it a name. To assign a name to the card data file double-right click on the icon and use the Browse button. Once the card data file has a name, you may double-left click on the icon to open the spreadsheet and insert card data values. In the following example, we will create and edit a source SPS file.



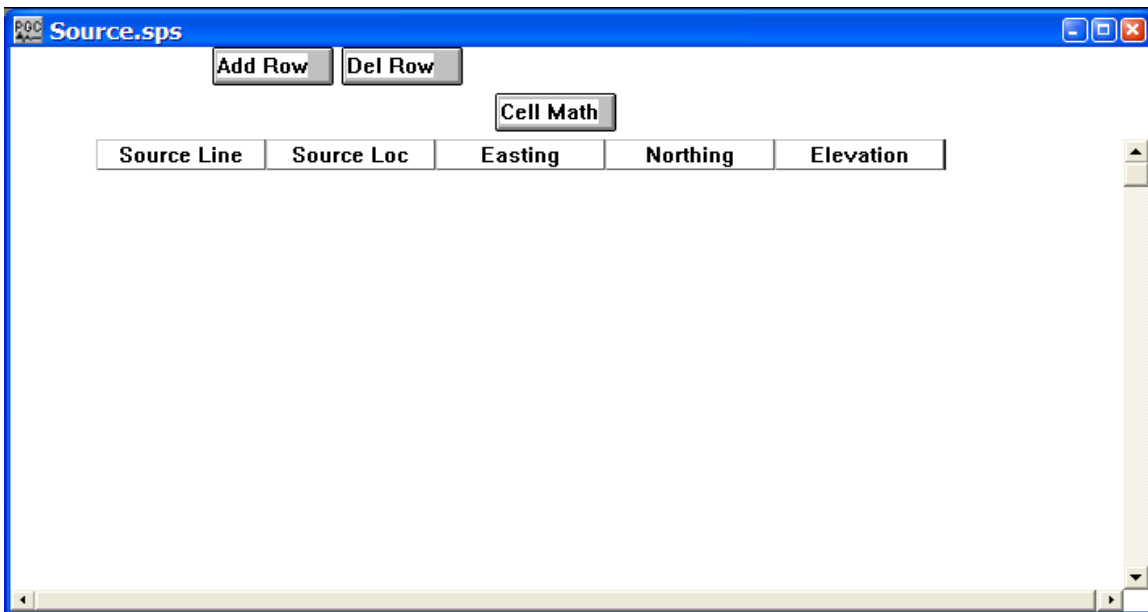
Step 1. Place the Source Locations – SPS Format card data file on the Flowchart canvas.



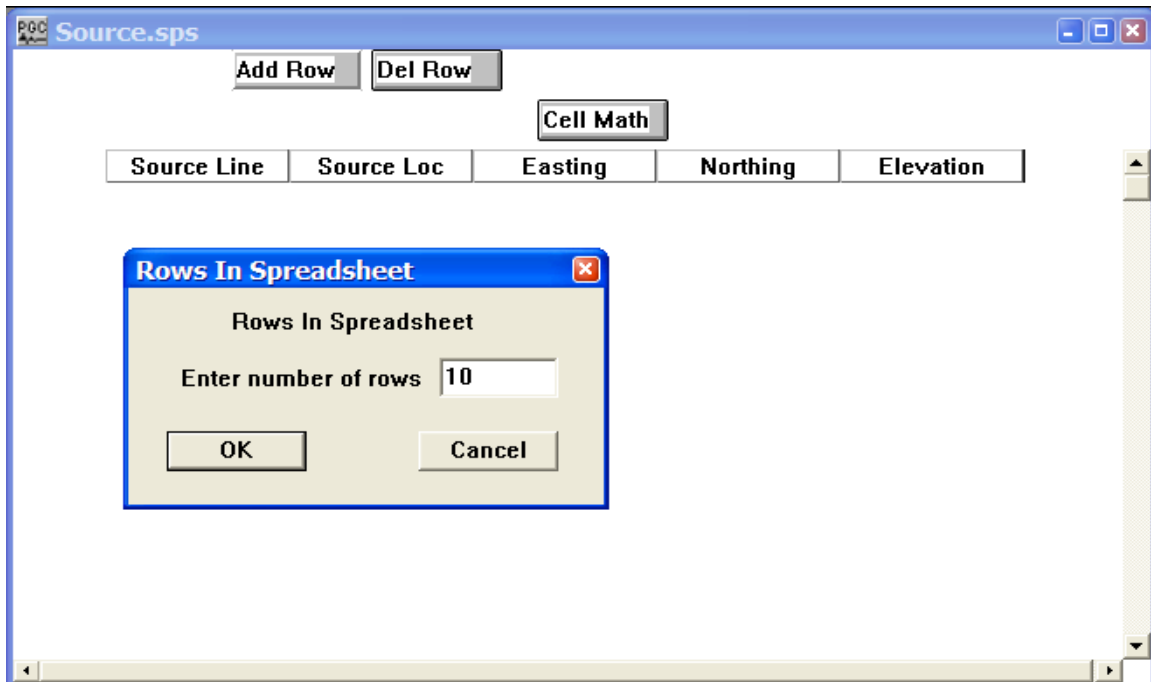
Step 2. Double-right click on the icon and use the Browse button to assign a name to the file.



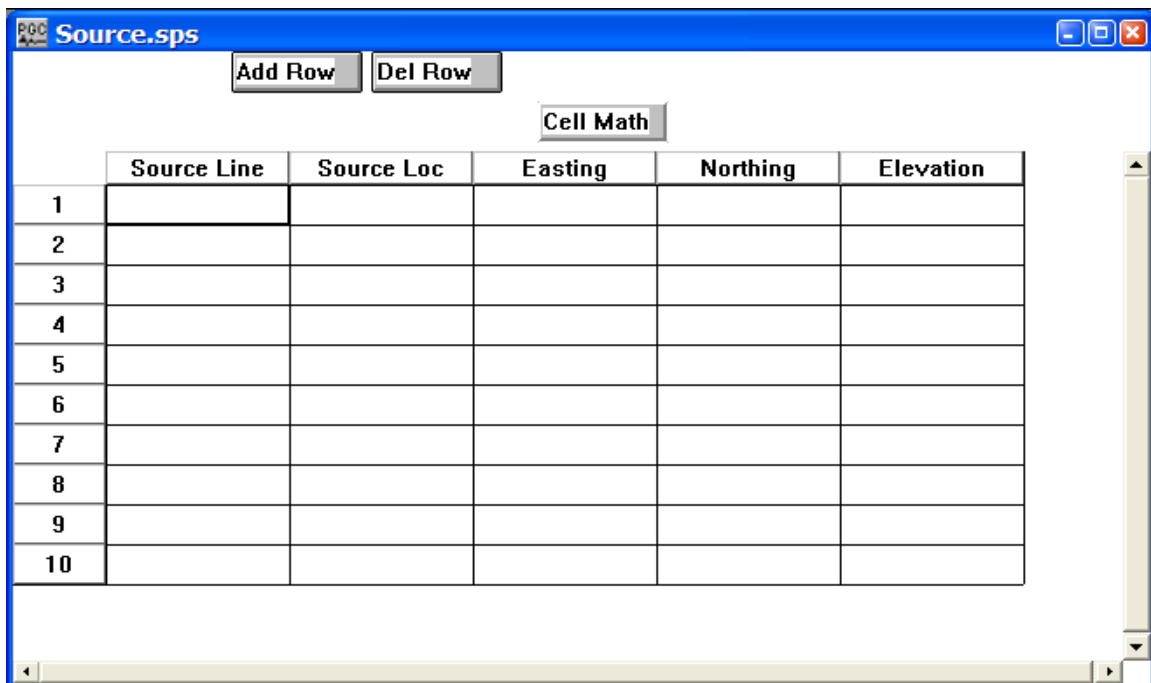
Step 3. Double-left click on the icon to access the spreadsheet of data values. Since the data file is currently empty, Flowchart will issue a warning message stating that it is unable to open the specified file, and that a new file will be created. Click OK.



Step 3 (cont.). An example of an empty Source Locations – SPS Format file.



Step 4. You can add a row at a time to the empty data file by using the Add Row button, or add multiple rows by clicking on the Add Row button while simultaneously pressing the Ctrl key on your keyboard. If you decide to add multiple rows, a dialog will appear on the screen requesting the number of rows you would like to add.



Step 4 (cont.). Now we have a spreadsheet full of empty cells and can begin to enter values. Most of the data values can be entered by using the Cell Math function.

Source.sps

Add Row Del Row

Cell Math

	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	1000.000000	1000.000000	100.000000
2		102		1025.000000	
3					
4					
5					
6					
7					
8					
9					
10					

Step 5. Fill out the values in the first row as well as those in the second row that are need to determine the series of subsequent values. In the case of the source location, the two values 101 and 102 are sufficient to determine that the source position advances by 1. In the case of the source northing, the two values 1000 and 1025 are sufficient to determine that the source northing advances by 25.

Source.sps

Add Row Del Row

Cell Math

	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	1000.000000	1000.000000	100.000000
2		102		1025.000000	
3					
4					
5					
6					
7					
8					
9					
10					

Step 6. Highlight the columns to which you will apply the Cell Math function. In this case we select the entire spreadsheet by clicking on the Source Line tab, holding down the mouse button, and scrolling over to the Elevation tab.

Cell Math

Cell Math

Add to Subtract from Modulo of

Multiply by Divide by Remainder of

Absolute value Math operand 1.000

Column Math

Add [A+B] Subtract [A-B]

Multiply [A*B] Divide [A/B]

Column A 1 Column B 2

Results Column 3

Clear cells Interpolate Done

Step 7. Click on the Cell Math button to view the functions available with the Cell Math tool. The Cell Math tool consists of intuitive functions that can be used to alter the values in card data spreadsheets or trace header spreadsheets. All we will do in this example is use the Interpolate function to fill out the remainder of the Source Locations – SPS Format file. Click on Interpolate.

Source.sps

Add Row Del Row

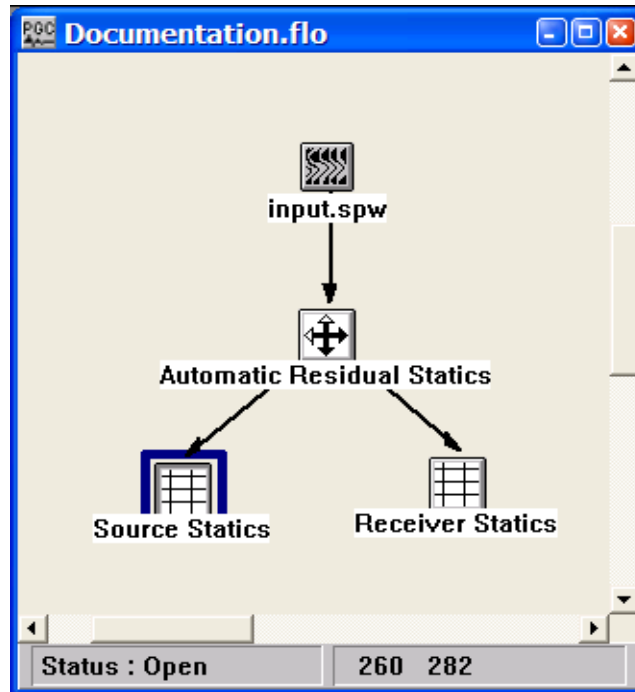
Cell Math

	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	1000.000000	1000.000000	100.000000
2	1	102	1000.000000	1025.000000	100.000000
3	1	103	1000.000000	1050.000000	100.000000
4	1	104	1000.000000	1075.000000	100.000000
5	1	105	1000.000000	1100.000000	100.000000
6	1	106	1000.000000	1125.000000	100.000000
7	1	107	1000.000000	1150.000000	100.000000
8	1	108	1000.000000	1175.000000	100.000000
9	1	109	1000.000000	1200.000000	100.000000
10	1	110	1000.000000	1225.000000	100.000000

Step 7 (cont.). The complete source SPS spreadsheet. Click on the red X in the upper right corner to close the spreadsheet. Be sure to save your changes.

Card Data Customization Dialog

The utility of the card data customization feature is best understood through an example. Consider the following job flow designed to compute automatic source and receiver residual statics.



Double clicking on the Source Statics icon brings up the following dialog, which allows you to set the file name of the output statics file with the Browse button, and to customize the format of the output statics file with the Customize button:

Source Statics Card File

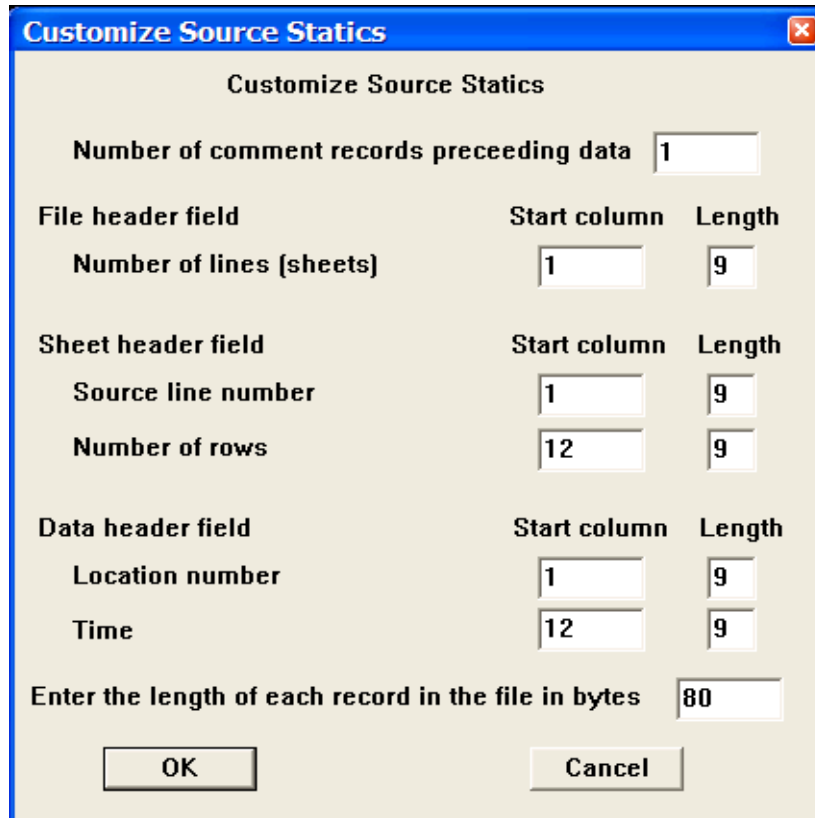
Enter the source statics card data file name :

\

Customize Browse

OK Cancel

Select the Customize button and the following dialog appears:



The dialog box is titled "Customize Source Statics" and contains several input fields for configuring source statics. It includes sections for comment records, file headers, sheet headers, data headers, and record length. Each section has labels for the field name, start column, and length. The fields are: "Number of comment records preceding data" (1), "File header field" (Number of lines (sheets) 1, Start column 1, Length 9), "Sheet header field" (Source line number 1, Start column 1, Length 9; Number of rows 12, Start column 1, Length 9), "Data header field" (Location number 1, Start column 1, Length 9; Time 12, Start column 1, Length 9), and "Enter the length of each record in the file in bytes" (80). There are OK and Cancel buttons at the bottom.

Field	Start column	Length
Number of comment records preceding data	1	
File header field		
Number of lines (sheets)	1	9
Sheet header field		
Source line number	1	9
Number of rows	12	9
Data header field		
Location number	1	9
Time	12	9
Enter the length of each record in the file in bytes		80

Parameter descriptions:

Number of comment records preceding data – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File header field – Indicates the number of sheets contained in the card data file. In the case of the source statics file above, there would be one sheet per source line.

Number of lines – Allows you to describe the formatting of the value indicating the number of source lines in the output source statics file.

Start column – Enter the column number to start writing the number of source lines in the output source statics file.

Length – Enter the number of columns reserved for writing the number of source lines in the output source statics file.

Sheet header field – Indicates the sheet number and the number of entries per sheet. In the case of the source statics file above, the sheet header line contains the source line number and the number of source locations on the line.

Source line number – Allows you to describe the formatting of the value indicating the source line number in the output source statics file.

Start column – Enter the column number to start writing the source line number in the output source statics file.

Length – Enter the number of columns reserved for writing the source line number in the output source statics file.

Number of rows – Allows you to describe the formatting of the value indicating the number of source locations in the output source statics file.

Start column – Enter the column number to start writing the number of source locations in the output source statics file.

Length – Enter the number of columns reserved for writing the number of source locations in the output source statics file.

Data header field – In the case of source statics, these header fields represents the source location number and the corresponding source static.

Location number – Allows you to describe the formatting of the value corresponding to the source location number in the output source statics file.

Start column – Enter the column number to start writing the source location number in the output data file.

Length – Enter the number of columns reserved for writing the source location number in the output source statics file.

Time – Allows you to describe the formatting of the value corresponding to the source location static in the output source statics file.

Start column – Enter the column number to start writing the source location static in the output source static file.

Length – Enter the number of columns reserved for writing the source location static in the output source static file.

The source statics card data file output with the above parameterization will have the following form (the comments with arrows have been added for explanation):

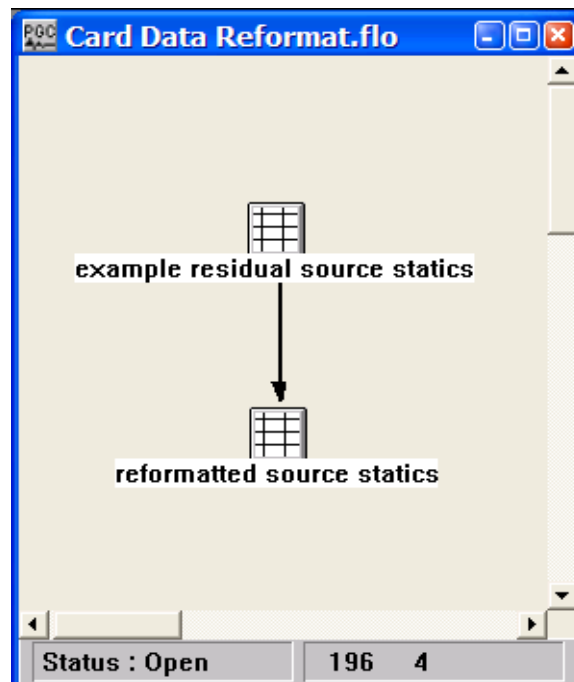
```

1234567890123456789012345678901234567890123456789012345678901234567890

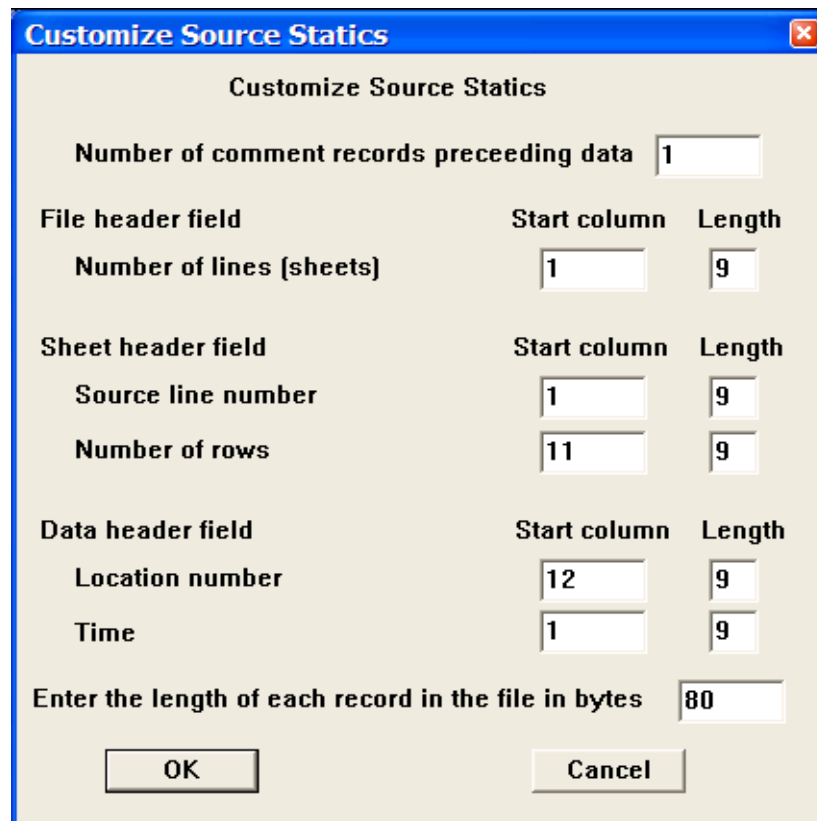
3 SPW Source Statics File <----- This is the comment card. The "3" indicates that it is a source statics card.
1 <----- This is the File Header Field. It indicates that there is only one source line.
101 38 <----- This is the Sheet Header Field. It indicates that the source static file is for
129.00000 4.573552 source line 101 and that there are 38 source location on the line
131.00000 2.207910 <----- These are the Data Header fields. They represent the source location and the
133.00000 0.807233 source static, respectively
135.00000 1.877282
137.00000 2.933568
139.00000 3.494154
141.00000 -0.313364
143.00000 -1.542512
145.00000 -1.266550
147.00000 2.684935
149.00000 1.179489
151.00000 -1.320091
153.00000 -1.376875
155.00000 -2.186443
157.00000 -2.035214
159.00000 1.223847
161.00000 -2.544334
163.00000 -4.461437
165.00000 -1.400349
167.00000 -2.104850
169.00000 -2.598595
171.00000 -0.642384
173.00000

```

To output this file to in a known foreign format, create a simple job that inputs the SPW static file and outputs the reformatted, foreign format file:



In this case, the card data customization dialog for the reformatted source statics file appears as follows, where the static value precedes the location number in the data field:



Customize Source Statics

Number of comment records preceeding data: 1

File header field	Start column	Length
Number of lines (sheets)	1	9

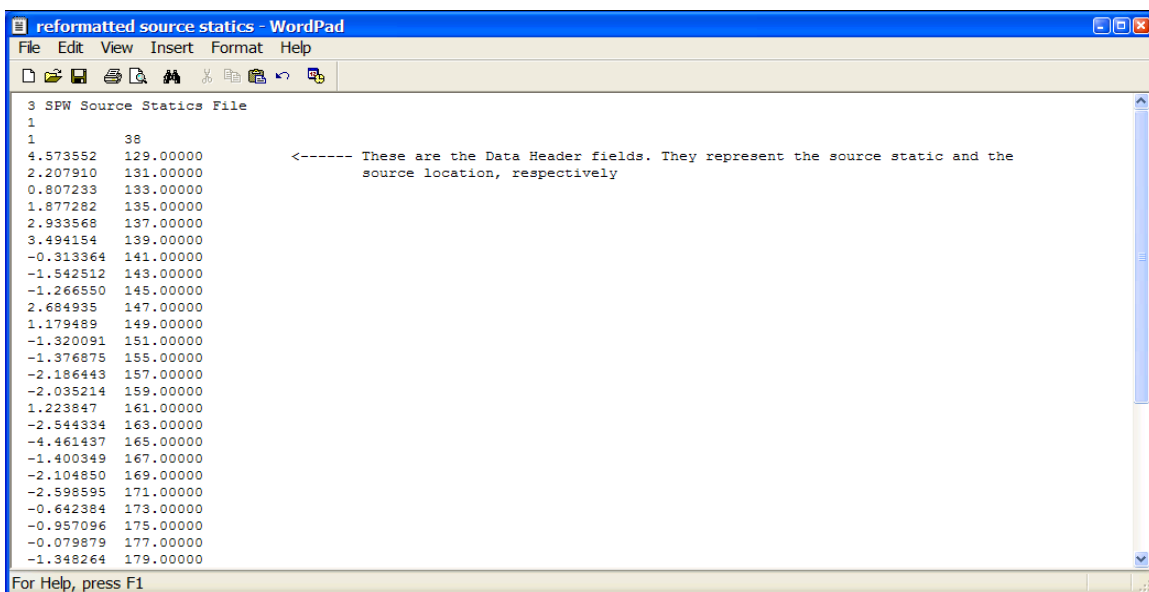
Sheet header field	Start column	Length
Source line number	1	9
Number of rows	11	9

Data header field	Start column	Length
Location number	12	9
Time	1	9

Enter the length of each record in the file in bytes: 80

OK Cancel

The resulting source statics card data file with this parameterization will have the source static value in the first column followed by location number in the second column:



```

3 SPW Source Statics File
1
1      38
4.573552 129.00000  <----- These are the Data Header fields. They represent the source static and the
2.207910 131.00000      source location, respectively
0.807233 133.00000
1.877282 135.00000
2.933568 137.00000
3.494154 139.00000
-0.313364 141.00000
-1.542512 143.00000
-1.266550 145.00000
2.684935 147.00000
1.179489 149.00000
-1.320091 151.00000
-1.376875 155.00000
-2.186443 157.00000
-2.035214 159.00000
1.223847 161.00000
-2.544334 163.00000
-4.461437 165.00000
-1.400349 167.00000
-2.104850 169.00000
-2.598595 171.00000
-0.642384 173.00000
-0.957096 175.00000
-0.079879 177.00000
-1.348264 179.00000
  
```

For Help, press F1

Creating Card Data in Excel

All of the card data types may be created in Microsoft Excel and transferred to SPW. To transfer a few data values, simply copy and paste from the Excel spreadsheet to the Card data spreadsheet. To transfer an entire file, you will need to reformat the Excel file as an SPW card data file. As an example we will create a receiver SPS file in Excel and reformat the file in Flowchart.

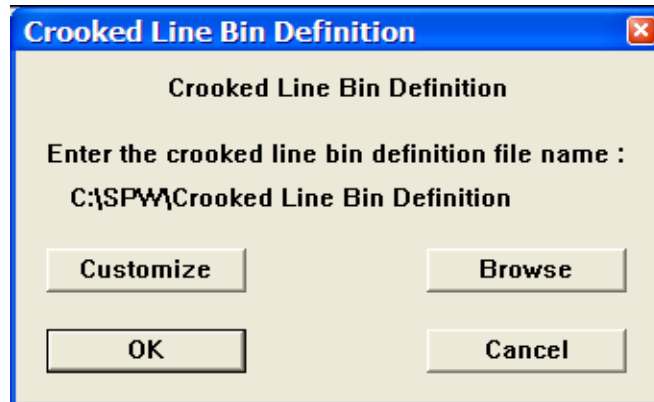
- Step 1: Open the Excel application.
- Step 2: Determine or set the width of the required amount of columns. Column width is set under the Format menu by selecting Column and then selecting width. The default width of an Excel spreadsheet column is 8.43, which means you will get 8 spaces when you save the file as a space delimited text file.
- Step 3: Left justify each of the columns that will contain numeric values.
- Step 4: Enter data values. In the case of a receiver SPS file there are five columns, which from column 1 to column 5 are labeled as Receiver Line, Receiver Location, Receiver Easting, Receiver Northing, and Receiver Elevation.
- Step 5: Save the file as a space delimited text file. To save a space delimited text file go to the File menu and select Save As. Open the Save as type drop down menu in the Save As dialog and select Formatted Text (Space delimited). The default extension for Formatted Text files is *.prn.
- Step 6: In Flowchart, select the appropriate Card Data item (in this case **Receiver Locations – SPS Format**) from the Processing List and place the item on the flow chart.
- Step 7: Locate the Formatted Text file created in Excel. To locate the file, double click on the card data icon in Flowchart and a Format File dialog will appear. Click on the Browse button and a Select File dialog will appear that allows you to maneuver through your directory structure and locate the file.
- Step 8: Customize the file format so that SPW can properly read your text file. To customize the file, click on the Customize button in the Format File dialog, and a Customize Format dialog will appear. In the case of the receiver SPS file created in Excel, we will load five columns (Line, Location, Easting, Northing, and Elevation), each of which is 8 characters wide. The starting column for Line number is 1 and the length of the Line field is 8. The starting column for the Location number is 9 and the length of the Location field is 8..... The starting column for the Elevation field is 33 and the length of the Elevation field is 8. When the appropriate parameters have been entered, select OK.
- Step 9: View the card data spreadsheet to verify the data values.

Crooked Line Bin Definition

Usage:

The Crooked Line Bin Definition card file is used to (1) store the best fit line to the scatter of CMP resulting from a crooked line seismic survey, and (2) to specify, and ultimately extract a random 2-D line from a 3-D data volume

Step Parameter Dialog:



Crooked Line Bin Definition

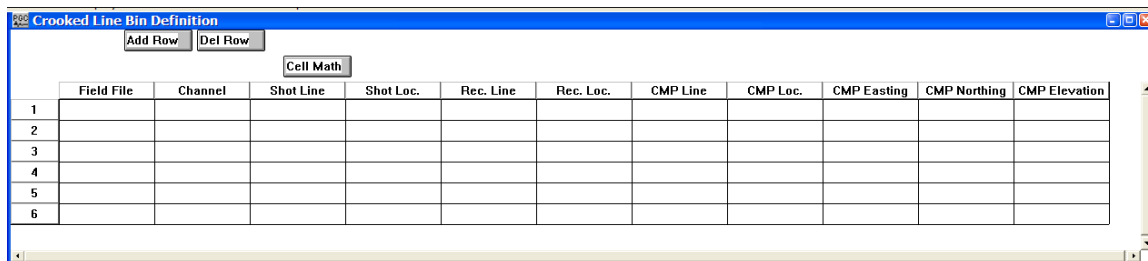
Crooked Line Bin Definition

Enter the crooked line bin definition file name :
C:\SPW\Crooked Line Bin Definition

Customize Browse

OK Cancel

Example Card Data:



Crooked Line Bin Definition

Add Row Del Row

Cell Math

	Field File	Channel	Shot Line	Shot Loc.	Rec. Line	Rec. Loc.	CMP Line	CMP Loc.	CMP Easting	CMP Northing	CMP Elevation
1											
2											
3											
4											
5											
6											

Card Data Customization Parameter Dialog:

Data header field	Start column	Length
Field file number	1	9
Channel	11	9
Shot Line	21	9
Shot Location	31	9
Receiver Line	41	9
Receiver Location	51	9
CMP Line	61	9
CMP Location	71	9

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

Data header field:

Field file number — Enter the start column and the number of columns allocated to write the Field File number associated with a given coordinate pair in the crooked line bin definition file.

Channel — Enter the start column and the number of columns allocated to write the channel number associated with a given coordinate pair in the crooked line bin definition file.

Shot Line — Enter the start column and the number of columns allocated to write the shot line associated with a given coordinate pair in the crooked line bin definition file.

Shot Location — Enter the start column and the number of columns allocated to write the shot location associated with a given coordinate pair in the crooked line bin definition file.

Receiver Line — Enter the start column and the number of columns allocated to write the receiver line associated with a given coordinate pair in the crooked line bin definition file.

Receiver Location — Enter the start column and the number of columns allocated to write the receiver location associated with a given coordinate pair in the crooked line bin definition file.

CMP Line — Enter the start column and the number of columns allocated to write the cmp line associated with a given coordinate pair in the crooked line bin definition file.

CMP Location — Enter the start column and the number of columns allocated to write the cmp location associated with a given coordinate pair in the crooked line bin definition file.

CMP Easting — Enter the start column and the number of columns allocated to write the cmp easting associated with a given coordinate pair in the crooked line bin definition file.

CMP Northing — Enter the start column and the number of columns allocated to write the cmp northing associated with a given coordinate pair in the crooked line bin definition file.

CMP Elevation — Enter the start column and the number of columns allocated to write the cmp elevation associated with a given coordinate pair in the crooked line bin definition file.

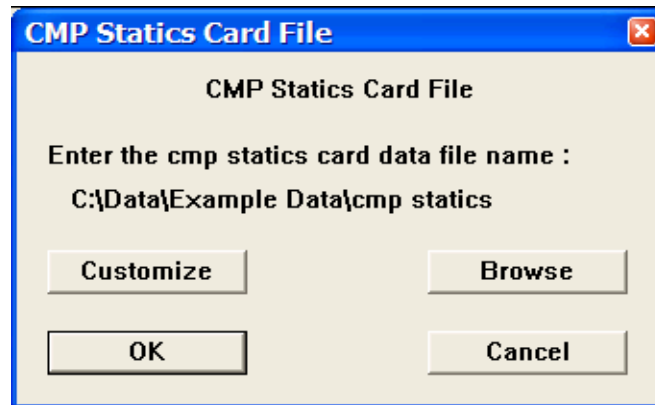
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the crooked line bin definition file.

CMP Statics

Usage:

The CMP Statics card data item is used to store CMP based static shift values in milliseconds.

Step Parameter Dialog:



The dialog box is titled "CMP Statics Card File". It contains a text field with the value "C:\Data\Example Data\cmp statics". Below the text field are four buttons: "Customize", "Browse", "OK", and "Cancel".

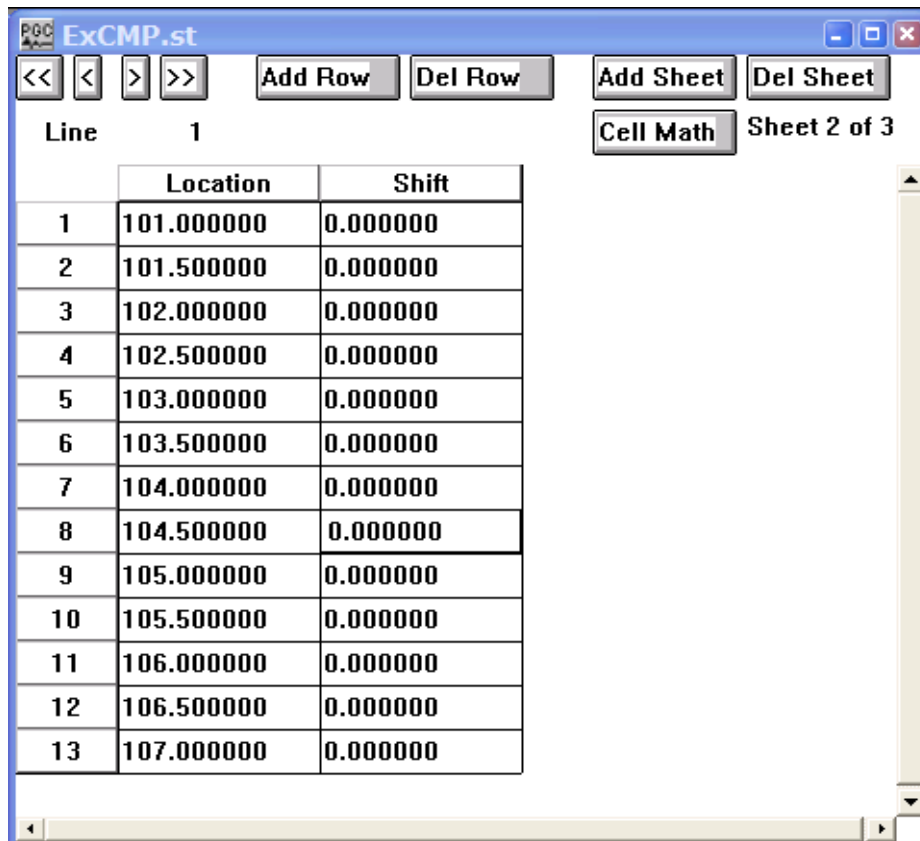
CMP Statics Card File

Enter the cmp statics card data file name :
C:\Data\Example Data\cmp statics

Customize Browse

OK Cancel

Example Card Data:



The screenshot shows a spreadsheet window titled "ExCMP.st". It has a menu bar with "PGC" and a toolbar with buttons for navigation and editing. The spreadsheet has a table with 13 rows and 3 columns: "Line", "Location", and "Shift". The "Line" column contains numbers 1 through 13. The "Location" column contains values from 101.000000 to 107.000000 in increments of 0.5. The "Shift" column contains the value 0.000000 for all rows. The window also shows "Sheet 2 of 3" and a "Cell Math" button.

Line	Location	Shift
1	101.000000	0.000000
2	101.500000	0.000000
3	102.000000	0.000000
4	102.500000	0.000000
5	103.000000	0.000000
6	103.500000	0.000000
7	104.000000	0.000000
8	104.500000	0.000000
9	105.000000	0.000000
10	105.500000	0.000000
11	106.000000	0.000000
12	106.500000	0.000000
13	107.000000	0.000000

Card Data Customization Parameter Dialog:

Customize CMP Statics

Number of comment records preceeding data

File header field

	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field

	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field

	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Time	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of CMP lines in the output CMP static file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write CMP line number in the output CMP static file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output CMP static file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the CMP location number in the output CMP static file.

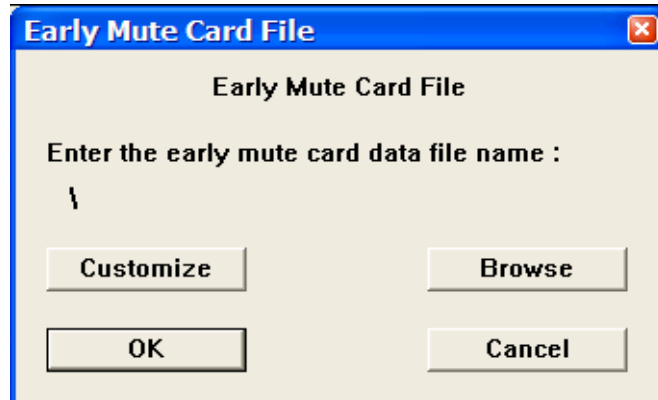
Time — Enter the start column and the number of columns allocated to write the CMP static value (in milliseconds) in the output CMP static file.

Early Mutes

Usage:

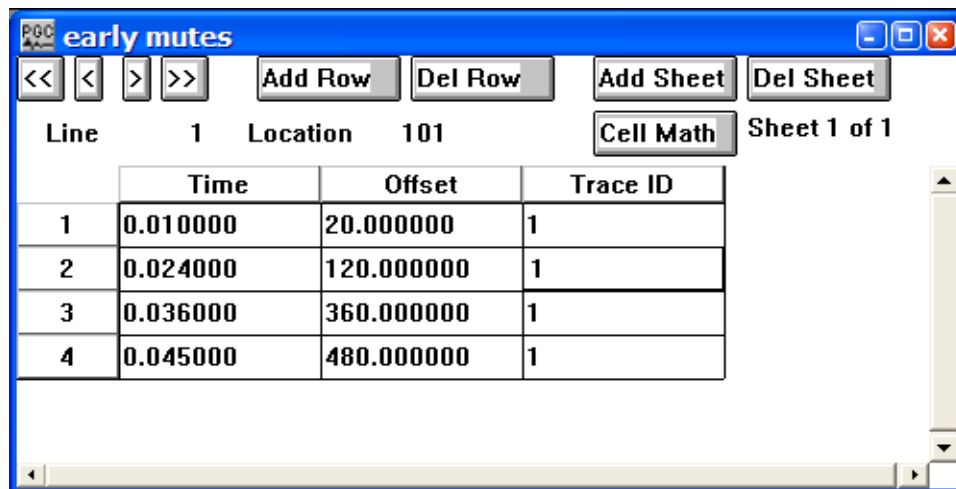
The Early Mutes card data item is used to store the mute definition for early (top) mutes. Mute times are in units of seconds. Early mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



The dialog box is titled "Early Mute Card File" and contains a text input field with the placeholder text "Enter the early mute card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window titled "early mutes" displays a table with 4 rows and 4 columns. The columns are labeled "Line", "Time", "Offset", and "Trace ID". The table contains the following data:

Line	Time	Offset	Trace ID
1	0.010000	20.000000	1
2	0.024000	120.000000	1
3	0.036000	360.000000	1
4	0.045000	480.000000	1

Additional UI elements include navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math" buttons. The status bar shows "Sheet 1 of 1".

Card Data Customization Parameter Dialog:

Customize Early Mute

Number of comment records preceeding data: 1

File header field

	Start column	Length
Number of mute locations (sheets)	1	9

Sheet header field

	Start column	Length
CMP line number	1	9
CMP location number	11	9
Number of rows	21	9
Sort order	31	9

Data header field

	Start column	Length
Time	1	9
Offset	11	9
Unique trace number	21	9

Enter the length of each record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of mute locations — Enter the start column and the number of columns allocated to write the number of mute locations in the output mute file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write the CMP line number in the output mute file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number in the output mute file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output mute file.

Sort order — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the early mute was picked.

Data header field:

Time — Enter the start column and the number of columns allocated to write the mute time (in milliseconds) at a specified offset and trace number in the output mute file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset corresponding to a specified mute time and trace number in the output mute file.

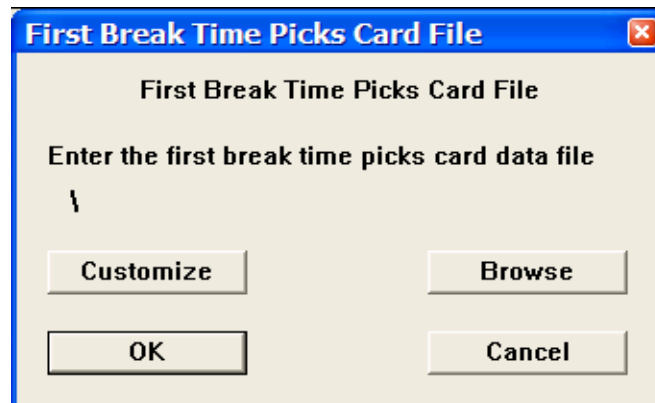
Unique trace number — Enter the start column and the number of columns allocated to write the unique trace number corresponding to a specified mute time and source-receiver offset in the output mute file.

First Break Time Picks

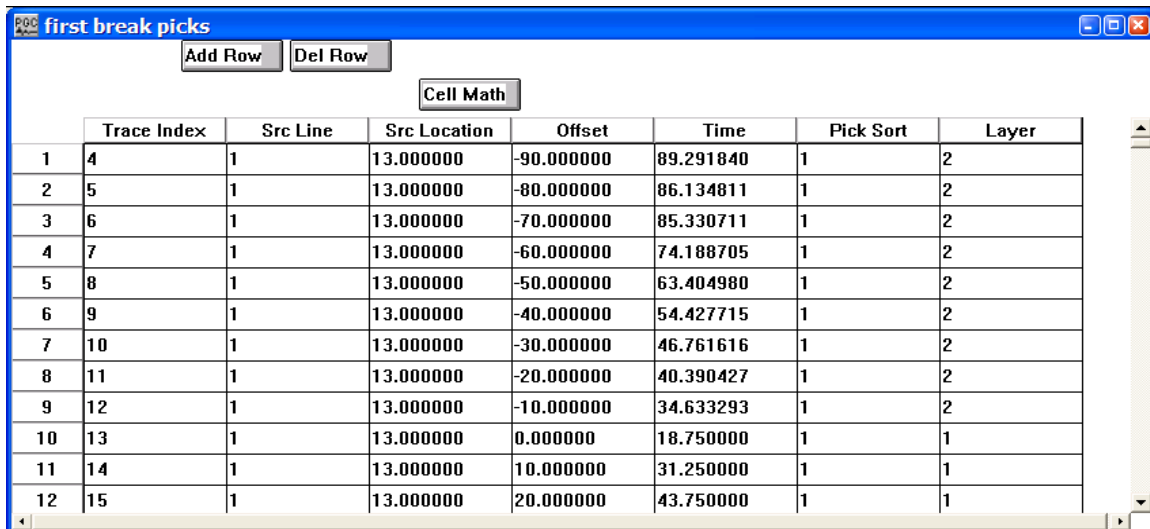
Usage:

The First Break Time Picks card data item is used to store the first break time picks (in milliseconds). First break may be picked interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:

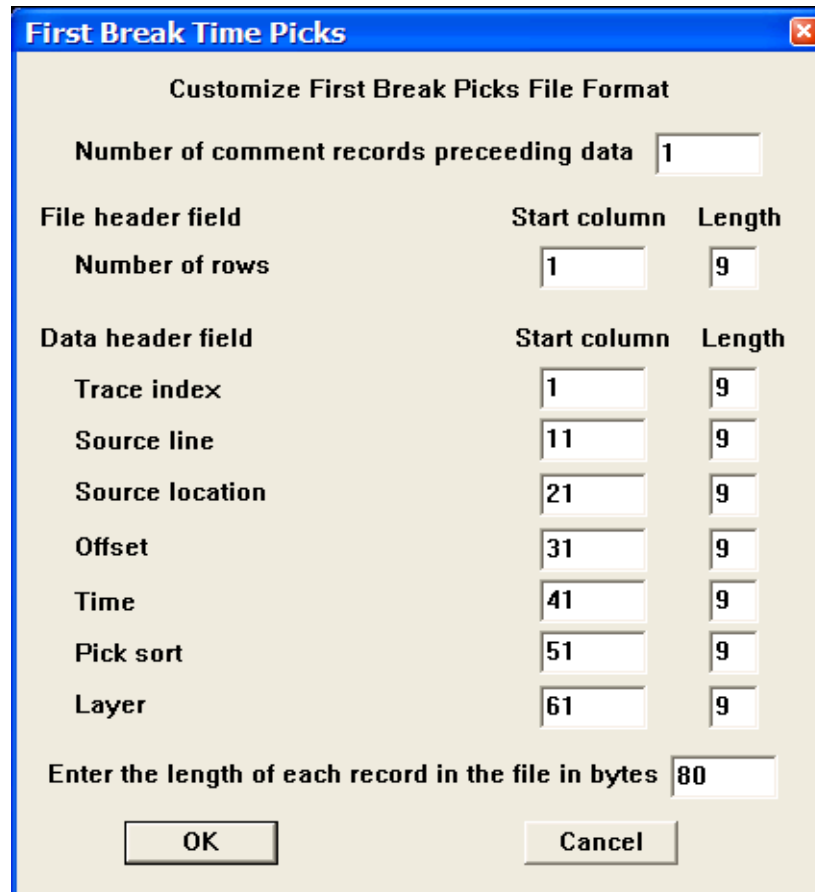


Example Card Data:

A screenshot of a software window titled "first break picks". It has a menu bar with "File", "Edit", and "Help". Below the menu bar are buttons for "Add Row", "Del Row", and "Cell Math". The main area contains a table with 8 columns: "Trace Index", "Src Line", "Src Location", "Offset", "Time", "Pick Sort", and "Layer". The table has 12 rows of data. The "Trace Index" column ranges from 1 to 12, "Src Line" from 4 to 15, "Src Location" is constant at 13.000000, "Offset" ranges from -90.000000 to 20.000000, "Time" ranges from 89.291840 to 43.750000, "Pick Sort" is constant at 1, and "Layer" ranges from 1 to 2.

	Trace Index	Src Line	Src Location	Offset	Time	Pick Sort	Layer
1	4	1	13.000000	-90.000000	89.291840	1	2
2	5	1	13.000000	-80.000000	86.134811	1	2
3	6	1	13.000000	-70.000000	85.330711	1	2
4	7	1	13.000000	-60.000000	74.188705	1	2
5	8	1	13.000000	-50.000000	63.404980	1	2
6	9	1	13.000000	-40.000000	54.427715	1	2
7	10	1	13.000000	-30.000000	46.761616	1	2
8	11	1	13.000000	-20.000000	40.390427	1	2
9	12	1	13.000000	-10.000000	34.633293	1	2
10	13	1	13.000000	0.000000	18.750000	1	1
11	14	1	13.000000	10.000000	31.250000	1	1
12	15	1	13.000000	20.000000	43.750000	1	1

Card Data Customization Parameter Dialog:



The dialog box is titled "First Break Time Picks" and contains a section "Customize First Break Picks File Format". It includes input fields for the number of comment records preceding data, file header field details (start column and length for number of rows), data header field details (start column and length for trace index, source line, source location, offset, time, pick sort, and layer), and a field for the length of each record in bytes. OK and Cancel buttons are at the bottom.

Customize First Break Picks File Format		
Number of comment records preceding data: 1		
File header field		
Number of rows	Start column: 1	Length: 9
Data header field		
Trace index	Start column: 1	Length: 9
Source line	Start column: 11	Length: 9
Source location	Start column: 21	Length: 9
Offset	Start column: 31	Length: 9
Time	Start column: 41	Length: 9
Pick sort	Start column: 51	Length: 9
Layer	Start column: 61	Length: 9
Enter the length of each record in the file in bytes: 80		
OK Cancel		

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the first break time picks in the output first break pick file.

Data header field:

Trace index — Enter the start column and the number of columns allocated to write the trace index value associated with the pick time in the first break pick file.

Source line — Enter the start column and the number of columns allocated to write the source line number associated with a specific pick time in the first break pick file.

Source location — Enter the start column and the number of columns allocated to write the source location number associated with a specific pick time in the first break pick file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset associated with a specific pick time in the first break pick file.

Time — Enter the start column and the number of columns allocated to write the pick time (in milliseconds) in the first break pick file.

Pick Sort — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the first break times were picked.

Time — Enter the start column and the number of columns allocated to write the layer number associated with a specific pick time in the first break pick file.

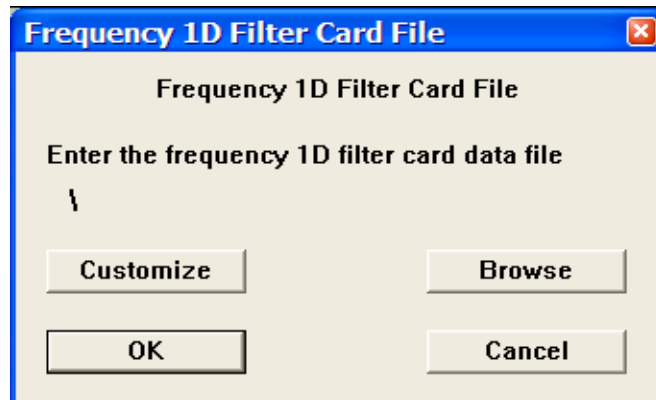
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output file.

Frequency Filter

Usage:

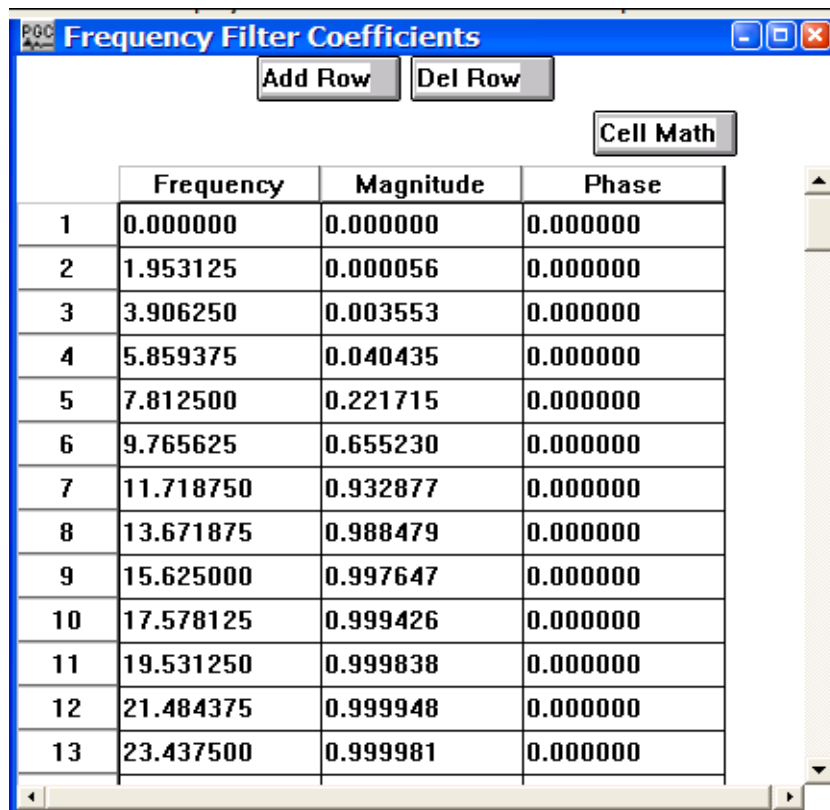
The Frequency Filter card data item is used to store the frequency-domain (transfer function) representation of a filter.

Step Parameter Dialog:



A dialog box titled "Frequency 1D Filter Card File" with a close button (X) in the top right corner. The main text inside says "Enter the frequency 1D filter card data file" followed by a backslash character. Below this text are four buttons: "Customize", "Browse", "OK", and "Cancel".

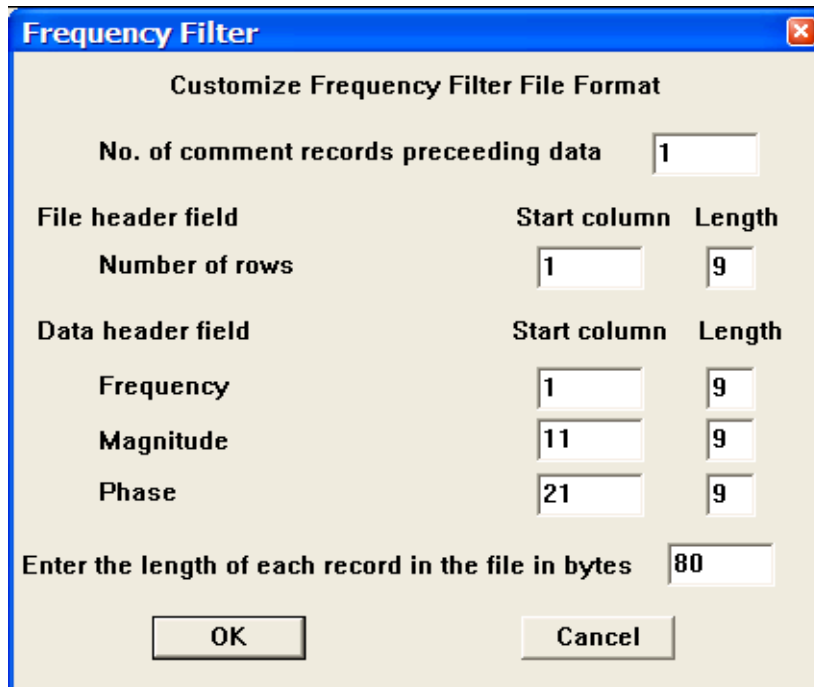
Example Card Data:



A window titled "Frequency Filter Coefficients" with a blue title bar and standard window controls. It contains a table with 4 columns: an index column, "Frequency", "Magnitude", and "Phase". Above the table are three buttons: "Add Row", "Del Row", and "Cell Math". The table contains 13 rows of data.

	Frequency	Magnitude	Phase
1	0.000000	0.000000	0.000000
2	1.953125	0.000056	0.000000
3	3.906250	0.003553	0.000000
4	5.859375	0.040435	0.000000
5	7.812500	0.221715	0.000000
6	9.765625	0.655230	0.000000
7	11.718750	0.932877	0.000000
8	13.671875	0.988479	0.000000
9	15.625000	0.997647	0.000000
10	17.578125	0.999426	0.000000
11	19.531250	0.999838	0.000000
12	21.484375	0.999948	0.000000
13	23.437500	0.999981	0.000000

Card Data Customization Parameter Dialog:



The dialog box is titled "Frequency Filter" and contains a section titled "Customize Frequency Filter File Format". It includes several input fields for configuring the file format. The "No. of comment records preceeding data" field is set to 1. The "File header field" section has a "Number of rows" field set to 1. The "Data header field" section has three rows: "Frequency" with start column 1 and length 9, "Magnitude" with start column 11 and length 9, and "Phase" with start column 21 and length 9. The "Enter the length of each record in the file in bytes" field is set to 80. There are "OK" and "Cancel" buttons at the bottom.

Customize Frequency Filter File Format		
No. of comment records preceeding data	1	
File header field		
Number of rows	1	9
Data header field		
Frequency	1	9
Magnitude	11	9
Phase	21	9
Enter the length of each record in the file in bytes	80	

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the frequency domain filter coefficients in the frequency filter file.

Data header field:

Frequency — Enter the start column and the number of columns allocated to write the frequency value in Hertz associated with a given magnitude and phase in the output frequency filter file.

Magnitude — Enter the start column and the number of columns allocated to write the magnitude value associated with a given frequency and phase in the output frequency filter file.

Phase — Enter the start column and the number of columns allocated to write the phase value associated with a given frequency and magnitude in the output frequency filter file.

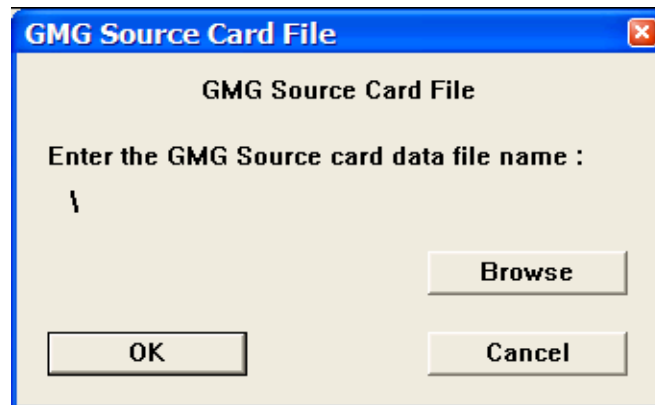
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output frequency filter file.

GMG Source Card File

Usage:

The GMG Source Card File is used to store source statics information previously computed with Green Mountain Geophysics refraction statics software. These files cannot be created manually in SPW.

Step Parameter Dialog:



Example Card Data:

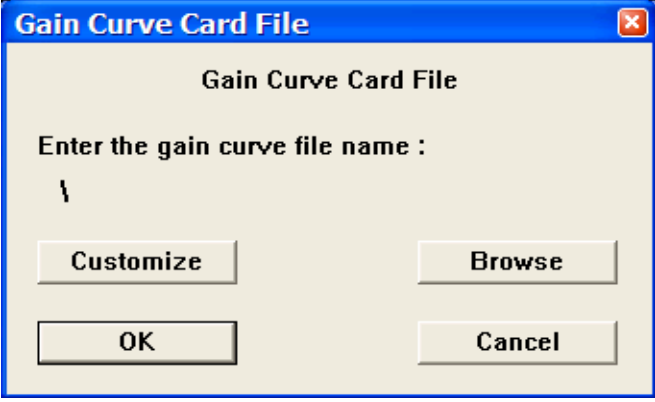
GMG Station Card File cont.

Gain Curves

Usage:

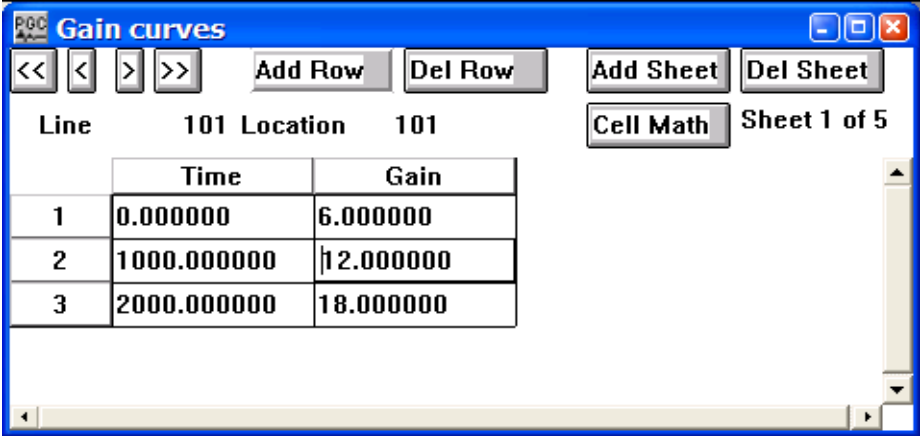
The Gain Curves card data item is used to store time-decibel gain pairs. A gain of 0 dB is equivalent to scalar multiplication by a factor of 1, a gain of 6 dB by a factor of 2, a gain of 12 dB by a factor of 4, a gain of 18 dB by a factor of 8, and so on. Time is in milliseconds.

Step Parameter Dialog:



A dialog box titled "Gain Curve Card File" with a standard Windows-style title bar (blue with a close button). The main area is light beige. It contains the text "Gain Curve Card File" at the top, followed by "Enter the gain curve file name :". Below this is a text input field containing a backslash character. At the bottom, there are four buttons: "Customize", "Browse", "OK", and "Cancel", arranged in two rows of two.

Example Card Data:



A screenshot of a software application window titled "Gain curves". The window has a blue title bar with standard Windows controls. Below the title bar is a toolbar with buttons: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The main area displays a table with the following data:

Line	101 Location	101
	Time	Gain
1	0.000000	6.000000
2	1000.000000	12.000000
3	2000.000000	18.000000

At the bottom right of the window, it says "Sheet 1 of 5".

Card Data Customization Parameter Dialog:

Customize Gain Curve File

Number of comment records preceeding data

File header field	Start column	Length
No. of gain locations (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Time	<input type="text" value="1"/>	<input type="text" value="9"/>
Gain in dB	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

No. of gain locations — Enter the start column and the number of columns allocated to write the number of gain locations in the output gain file.

Sheet Header field:

Line number — Enter the start column and the number of columns allocated to write the line number associated with a gain location in the output gain file.

Location number — Enter the start column and the number of columns allocated to write the location number associated with a gain location in the output gain file.

Number of rows — Enter the start column and the number of columns allocated to write the number of gain locations per line in the output gain file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the two-way time (in milliseconds) associated with a given gain value in the output gain file.

Gain in dB — Enter the start column and the number of columns allocated to write the gain in dB associated with a given two-way travel time in the output gain file.

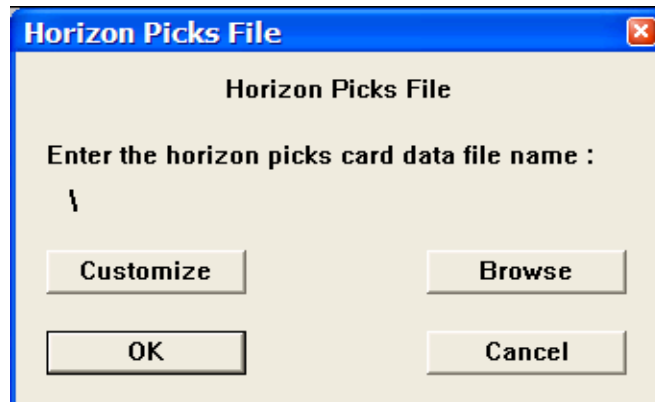
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output frequency filter file.

Horizon File

Usage:

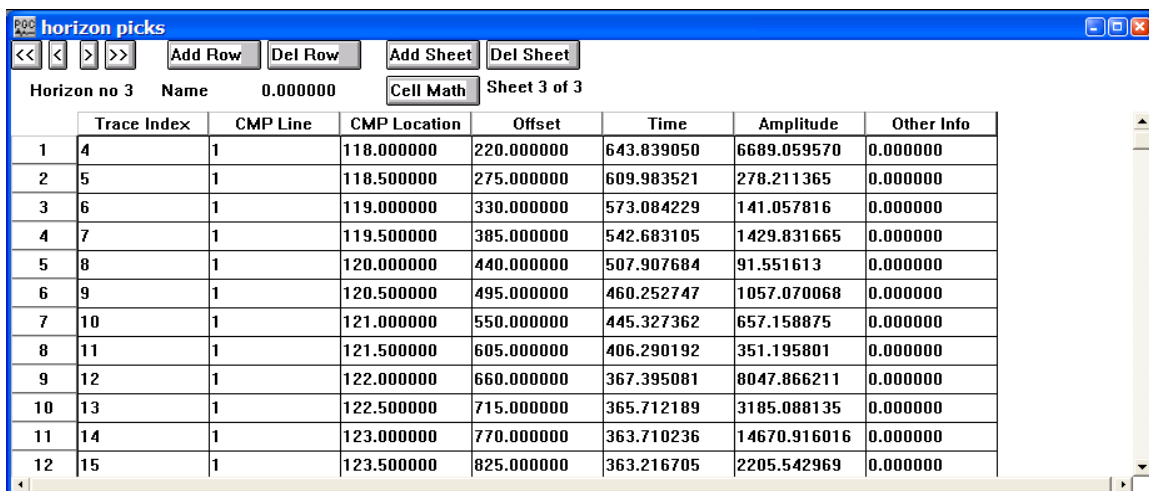
The Horizon File card data item is used to store horizon time picks. Horizon event picking may be performed interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



A dialog box titled "Horizon Picks File" with a blue border and a close button in the top right corner. The title bar also contains the text "Horizon Picks File". Inside the dialog, the text "Enter the horizon picks card data file name :" is followed by a text input field containing a backslash character "\". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



A screenshot of the "horizon picks" window. The window has a blue title bar with the text "horizon picks" and standard window controls. Below the title bar is a toolbar with buttons: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", and "Del Sheet". Below the toolbar, there is a status bar showing "Horizon no 3", "Name", "0.000000", "Cell Math", and "Sheet 3 of 3". The main area of the window contains a table with 8 columns: "Trace Index", "CMP Line", "CMP Location", "Offset", "Time", "Amplitude", and "Other Info". The table has 12 rows of data.

	Trace Index	CMP Line	CMP Location	Offset	Time	Amplitude	Other Info
1	4	1	118.000000	220.000000	643.839050	6689.059570	0.000000
2	5	1	118.500000	275.000000	609.983521	278.211365	0.000000
3	6	1	119.000000	330.000000	573.084229	141.057816	0.000000
4	7	1	119.500000	385.000000	542.683105	1429.831665	0.000000
5	8	1	120.000000	440.000000	507.907684	91.551613	0.000000
6	9	1	120.500000	495.000000	460.252747	1057.070068	0.000000
7	10	1	121.000000	550.000000	445.327362	657.158875	0.000000
8	11	1	121.500000	605.000000	406.290192	351.195801	0.000000
9	12	1	122.000000	660.000000	367.395081	8047.866211	0.000000
10	13	1	122.500000	715.000000	365.712189	3185.088135	0.000000
11	14	1	123.000000	770.000000	363.710236	14670.916016	0.000000
12	15	1	123.500000	825.000000	363.216705	2205.542969	0.000000

Card Data Customization Parameter Dialog:

Customize Horizon Time Picks

Customize Horizon Pick File Format

No. of comment records preceeding data

File header field	Start column	Length
Number of horizons (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Horizon number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="8"/>

Data header field	Start column	Length
Trace index number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP line	<input type="text" value="11"/>	<input type="text" value="9"/>
CMP location	<input type="text" value="21"/>	<input type="text" value="9"/>
Offset	<input type="text" value="31"/>	<input type="text" value="9"/>
Time	<input type="text" value="41"/>	<input type="text" value="9"/>
Amplitude	<input type="text" value="51"/>	<input type="text" value="9"/>
Other info	<input type="text" value="61"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of horizons — Enter the start column and the number of columns allocated to write the number of horizons in the output horizon file.

Sheet Header field:

Horizon number — Enter the start column and the number of columns allocated to write the horizon number associated with a given horizon in the output horizon file.

Number of rows — Enter the start column and the number of columns allocated to write the number of time picks per horizon in the output horizon file.

Data header field:

Trace index number — Enter the start column and the number of columns allocated to write the trace index number associated with a given horizon time pick in the output horizon file.

CMP Line — Enter the start column and the number of columns allocated to write the CMP line number associated with a given horizon time pick in the output horizon file.

CMP Location — Enter the start column and the number of columns allocated to write the CMP location number associated with a given horizon time pick in the output horizon file.

Offset — Enter the start column and the number of columns allocated to write the offset in meters (from the first CMP on the line for a stacked section) associated with a given horizon time pick in the output horizon file.

Time — Enter the start column and the number of columns allocated to write the two-way time (in milliseconds) associated with a given horizon pick in the output horizon file.

Amplitude — Enter the start column and the number of columns allocated to write the amplitude of the event associated with a given horizon pick in the output horizon file.

Other info — Enter the start column and the number of columns allocated to write the additional information in the output horizon file.

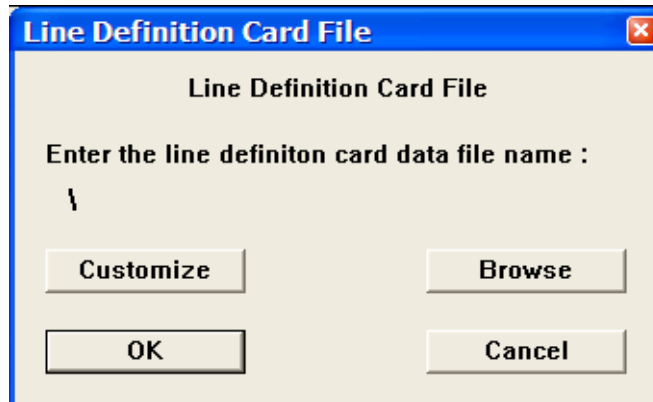
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output frequency filter file.

Line Definition File

Usage:

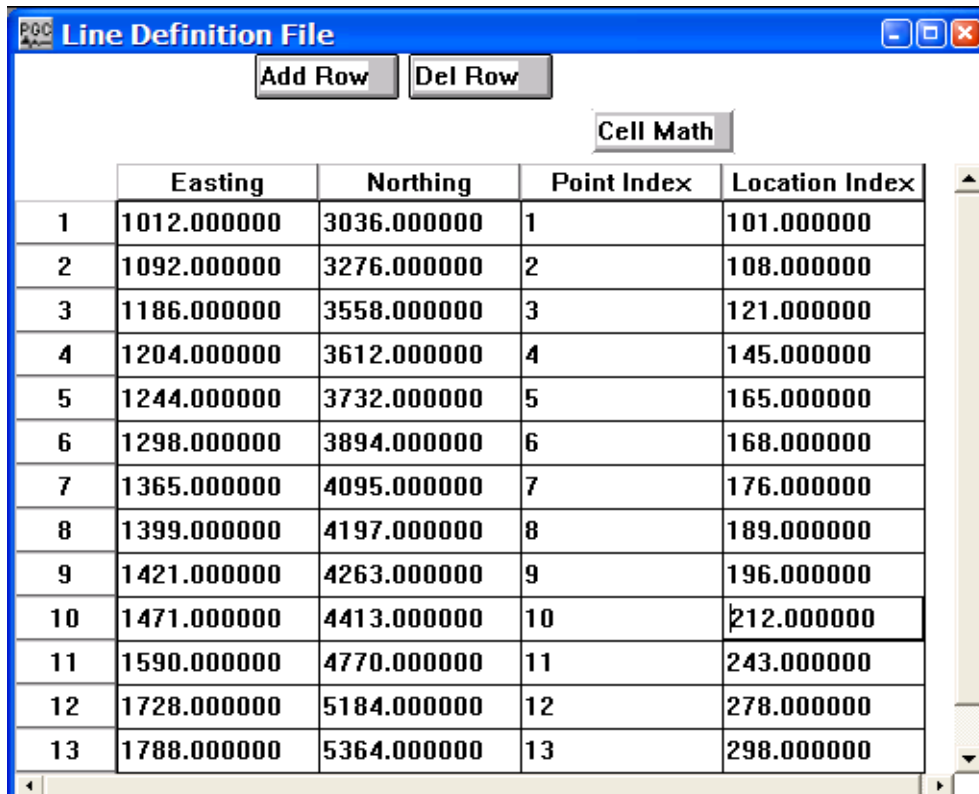
The Line Definition File card data is used to (1) store the best fit line to the scatter of CMP resulting from a crooked line seismic survey, and (2) to specify, and ultimately extract a random 2-D line from a 3-D data volume

Step Parameter Dialog:



The dialog box titled "Line Definition Card File" has a blue title bar with a close button. The main area is light gray and contains the text "Line Definition Card File" and "Enter the line definition card data file name :". Below this is a text input field containing a backslash character. At the bottom, there are four buttons: "Customize", "Browse", "OK", and "Cancel".

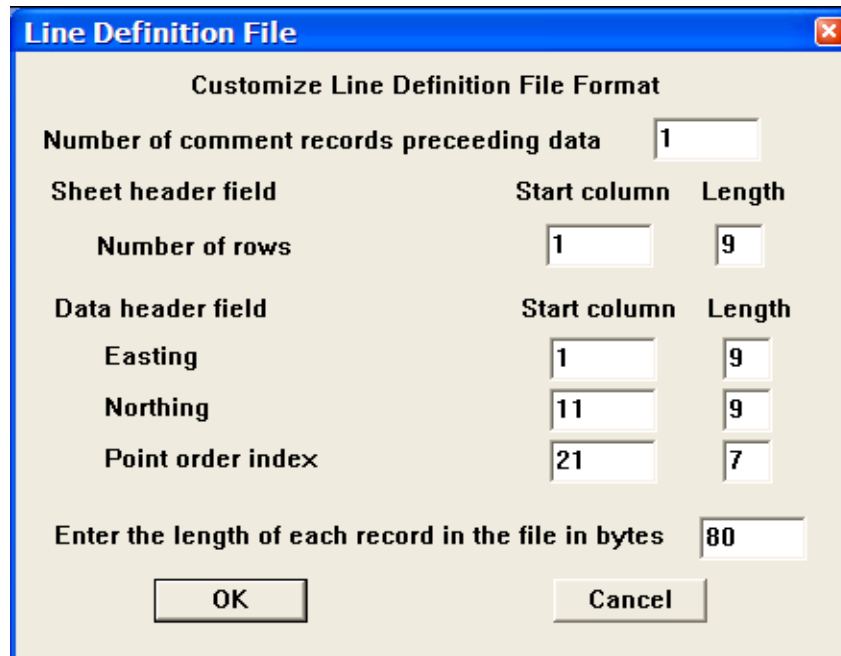
Example Card Data:



The window titled "Line Definition File" has a blue title bar with standard window controls. Below the title bar are three buttons: "Add Row", "Del Row", and "Cell Math". The main area contains a table with 5 columns: an unlabeled index column, "Easting", "Northing", "Point Index", and "Location Index". The table has 13 rows of data. A vertical scrollbar is on the right side of the table.

	Easting	Northing	Point Index	Location Index
1	1012.000000	3036.000000	1	101.000000
2	1092.000000	3276.000000	2	108.000000
3	1186.000000	3558.000000	3	121.000000
4	1204.000000	3612.000000	4	145.000000
5	1244.000000	3732.000000	5	165.000000
6	1298.000000	3894.000000	6	168.000000
7	1365.000000	4095.000000	7	176.000000
8	1399.000000	4197.000000	8	189.000000
9	1421.000000	4263.000000	9	196.000000
10	1471.000000	4413.000000	10	212.000000
11	1590.000000	4770.000000	11	243.000000
12	1728.000000	5184.000000	12	278.000000
13	1788.000000	5364.000000	13	298.000000

Card Data Customization Parameter Dialog:



The dialog box is titled "Line Definition File" and contains the following fields and controls:

- Number of comment records preceeding data:** A text box containing the value "1".
- Sheet header field:**
 - Number of rows:** A text box containing the value "1".
 - Start column:** A text box containing the value "1".
 - Length:** A text box containing the value "9".
- Data header field:**
 - Easting:** A text box containing the value "1".
 - Northing:** A text box containing the value "11".
 - Point order index:** A text box containing the value "21".
- Enter the length of each record in the file in bytes:** A text box containing the value "80".
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

Sheet Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of coordinate pairs used to define the line in the output line definition file.

Data header field:

Easting — Enter the start column and the number of columns allocated to write the easting associated with a given coordinate pair in the output line definition file.

Northing — Enter the start column and the number of columns allocated to write the northing associated with a given coordinate pair in the output line definition file.

Point order index — Enter the start column and the number of columns allocated to write the point index associated with a given coordinate pair in the output line definition file.

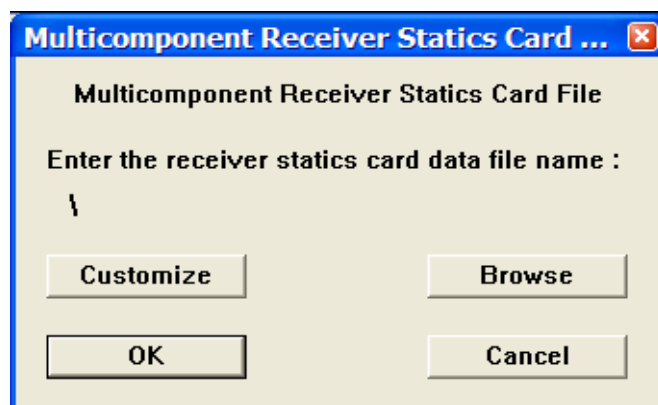
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output line definition file.

Multicomponent Receiver Statics File

Usage:

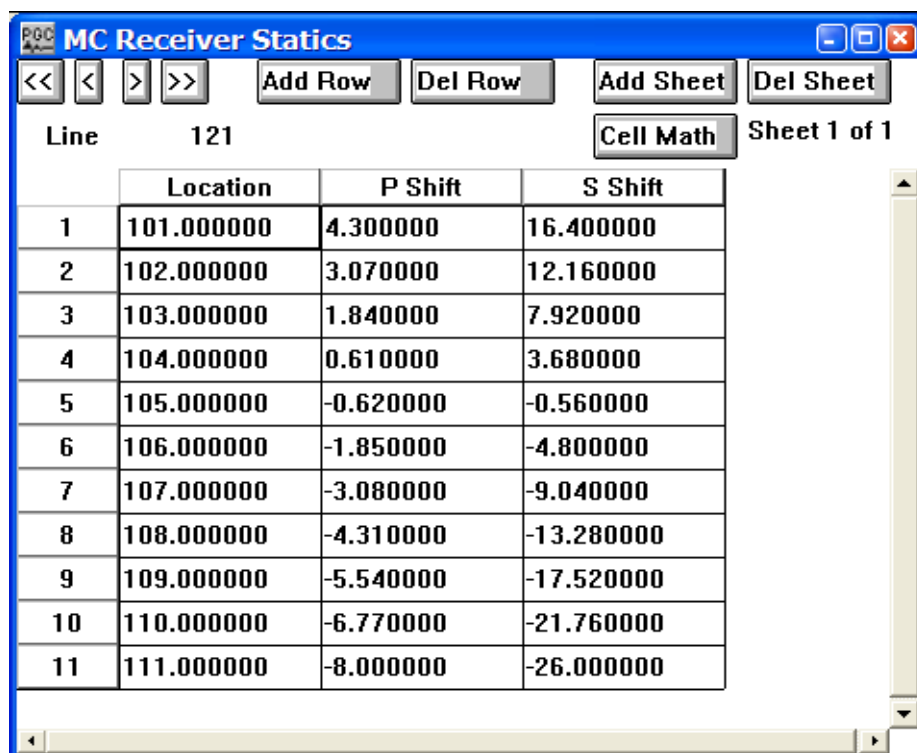
The Multicomponent Receiver Statics card data is used to store unique receiver statics for multicomponent data volumes containing P-wave arrivals, S-wave arrivals, and/or PS-wave converted arrivals. Static values are stored in units of milliseconds.

Step Parameter Dialog:



The dialog box is titled "Multicomponent Receiver Statics Card ...". It contains the text "Multicomponent Receiver Statics Card File" and "Enter the receiver statics card data file name :". Below the text is a text input field containing a backslash character. At the bottom, there are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The application window is titled "MC Receiver Statics". It features a toolbar with buttons for navigation and data manipulation: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar indicates "Line 121" and "Sheet 1 of 1". The main area displays a table with the following data:

	Location	P Shift	S Shift
1	101.000000	4.300000	16.400000
2	102.000000	3.070000	12.160000
3	103.000000	1.840000	7.920000
4	104.000000	0.610000	3.680000
5	105.000000	-0.620000	-0.560000
6	106.000000	-1.850000	-4.800000
7	107.000000	-3.080000	-9.040000
8	108.000000	-4.310000	-13.280000
9	109.000000	-5.540000	-17.520000
10	110.000000	-6.770000	-21.760000
11	111.000000	-8.000000	-26.000000

Card Data Customization Parameter Dialog:

Customize Multicomponent Receiver Statics

Customize Multicomponent Receiver Statics

Number of comment records preceding data: 1

File header field	Start column	Length
Number of lines (sheets)	1	9

Sheet header field	Start column	Length
Receiver line number	1	9
Number of rows	11	9

Data header field	Start column	Length
Location number	1	9
Time	11	9

Enter the length of each record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Number of comment records preceding data: — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver lines in the output multicomponent receiver statics file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write the receiver line number in the output multicomponent receiver statics file.

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver stations in the output multicomponent receiver statics file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the receiver location number in the multicomponent receiver statics file.

Time — Enter the start column and the number of columns allocated to write the receiver static (in milliseconds) in the receiver static file.

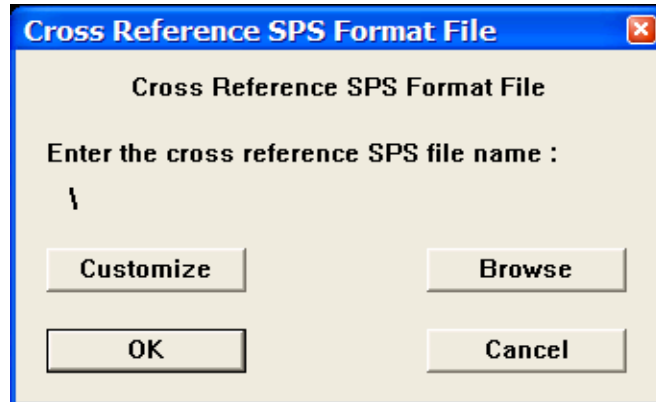
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the output multi-component receiver statics file.

Observers Notes – SPS Format

Usage:

The Observer Notes card data item is used to store the relational acquisition geometry information for sources and receivers. In the SPS lingo this is referred to as the Cross Reference file. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).

Step Parameter Dialog:



A dialog box titled "Cross Reference SPS Format File" with a close button (X) in the top right corner. The main text inside says "Enter the cross reference SPS file name :". Below this text is a text input field containing a backslash character (\). At the bottom of the dialog, there are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:

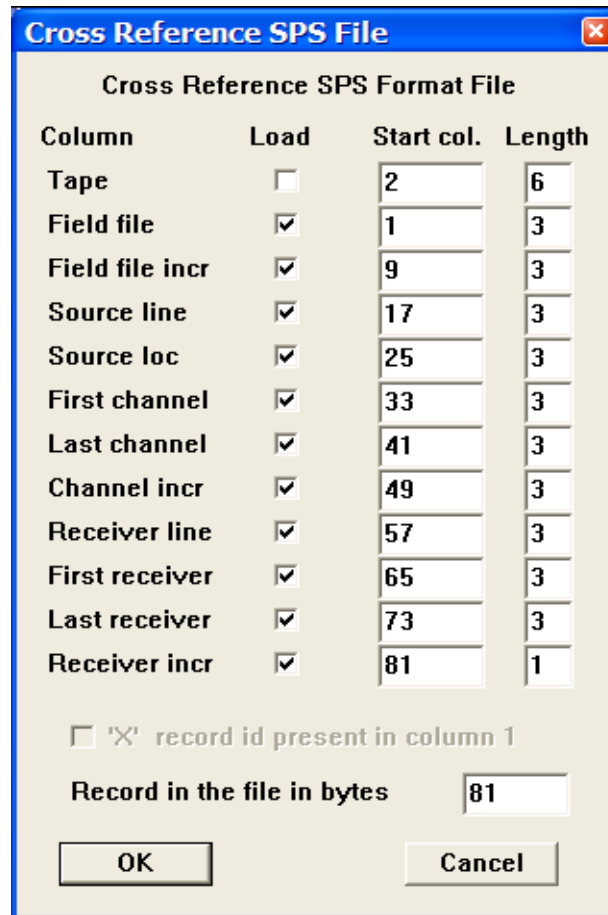
ExObs.sps

Add RowDel Row

Cell Math

	Field File	FFN Incr.	Src. Line	Src. Loc	First Channel	Last Channel	Channel Incr.	Recv. Line	First Recv.	Last Recv.	Recv. Incr.
1	15		1	129	1	24	1	1	104	127	1
2	15		1	129	25	48	1	1	131	154	1
3	16		1	131	1	24	1	1	106	129	1
4	16		1	131	25	48	1	1	133	156	1
5	17		1	133	1	24	1	1	108	131	1
6	17		1	133	25	48	1	1	135	158	1
7	18		1	135	1	24	1	1	110	133	1
8	18		1	135	25	48	1	1	137	160	1
9	19		1	137	1	24	1	1	112	135	1
10	19		1	137	25	48	1	1	139	162	1
11	20		1	139	1	24	1	1	114	137	1
12	20		1	139	25	48	1	1	141	164	1

Card Data Customization Parameter Dialog:



The dialog box is titled "Cross Reference SPS File" and contains a section "Cross Reference SPS Format File". It features a table with four columns: "Column", "Load", "Start col.", and "Length". The table lists various parameters for SPS file formatting, including Tape, Field file, Field file incr, Source line, Source loc, First channel, Last channel, Channel incr, Receiver line, First receiver, Last receiver, and Receiver incr. Each parameter has a "Load" checkbox, a "Start col." text box, and a "Length" text box. Below the table, there is a checkbox for "'X' record id present in column 1" and a text box for "Record in the file in bytes" with the value "81". At the bottom are "OK" and "Cancel" buttons.

Column	Load	Start col.	Length
Tape	<input type="checkbox"/>	2	6
Field file	<input checked="" type="checkbox"/>	1	3
Field file incr	<input checked="" type="checkbox"/>	9	3
Source line	<input checked="" type="checkbox"/>	17	3
Source loc	<input checked="" type="checkbox"/>	25	3
First channel	<input checked="" type="checkbox"/>	33	3
Last channel	<input checked="" type="checkbox"/>	41	3
Channel incr	<input checked="" type="checkbox"/>	49	3
Receiver line	<input checked="" type="checkbox"/>	57	3
First receiver	<input checked="" type="checkbox"/>	65	3
Last receiver	<input checked="" type="checkbox"/>	73	3
Receiver incr	<input checked="" type="checkbox"/>	81	1

☐ 'X' record id present in column 1

Record in the file in bytes: 81

OK Cancel

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Tape — Enter the start column and the number of columns allocated to write the tape number (disk or physical) associated with a given record in the Cross Reference SPS file.

Field file — Enter the start column and the number of columns allocated to write the field file number associated with a given record in the Cross Reference SPS file.

Field file incr. — Enter the start column and the number of columns allocated to write the increment between field files in the Cross Reference SPS file.

Source line — Enter the start column and the number of columns allocated to write the source line number associated with a given record in the Cross Reference SPS file.

Source location — Enter the start column and the number of columns allocated to write the source location number associated with a given record in the Cross Reference SPS file.

First channel — Enter the start column and the number of columns allocated to write the first channel associated with a given record in the Cross Reference SPS file.

Last channel — Enter the start column and the number of columns allocated to write the last channel associated with a given record in the Cross Reference SPS file.

Channel incr — Enter the start column and the number of columns allocated to write the increment between channels associated with a given record in the Cross Reference SPS file.

Receiver line — Enter the start column and the number of columns allocated to write the receiver line number associated with a given record in the Cross Reference SPS file.

First receiver — Enter the start column and the number of columns allocated to write the first receiver associated with a given record in the Cross Reference SPS file.

Last receiver — Enter the start column and the number of columns allocated to write the last receiver associated with a given record in the Cross Reference SPS file.

Receiver incr — Enter the start column and the number of columns allocated to write the increment between receivers associated with a given record in the Cross Reference SPS file.

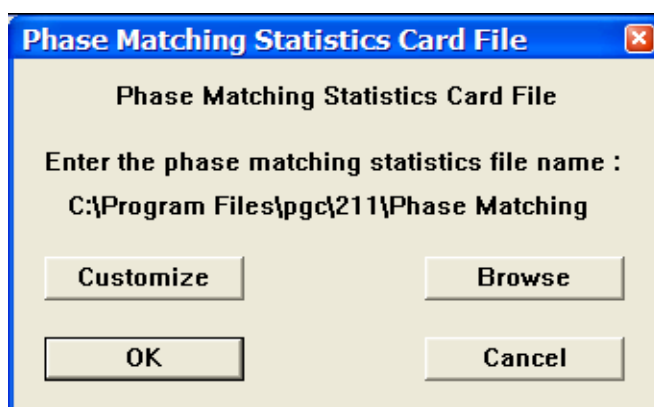
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS Observer Notes file.

Phase Matching Statistics File

Usage:

The Phase Matching Statistics card data item stores the statistical output of the Phase Matching processing step. In addition to the phase rotation and the static shift required to match one data set to another, the Phase Matching Statistics card stores the CMP Line number, CMP Location number, CMP Easting, and CMP Northing for each pair of traces for which a phase matching analysis was performed. The phase rotation is stored in User Def 1, and the static shift is stored in User Def 2. The Phase Matching step contains an option to output the correlation coefficient between the two data sets after the auxiliary data has been rotated and shifted. The correlation coefficient is stored in User Def 3.

Step Parameter Dialog:



Phase Matching Statistics Card File

Enter the phase matching statistics file name :

C:\Program Files\pgc\211\Phase Matching

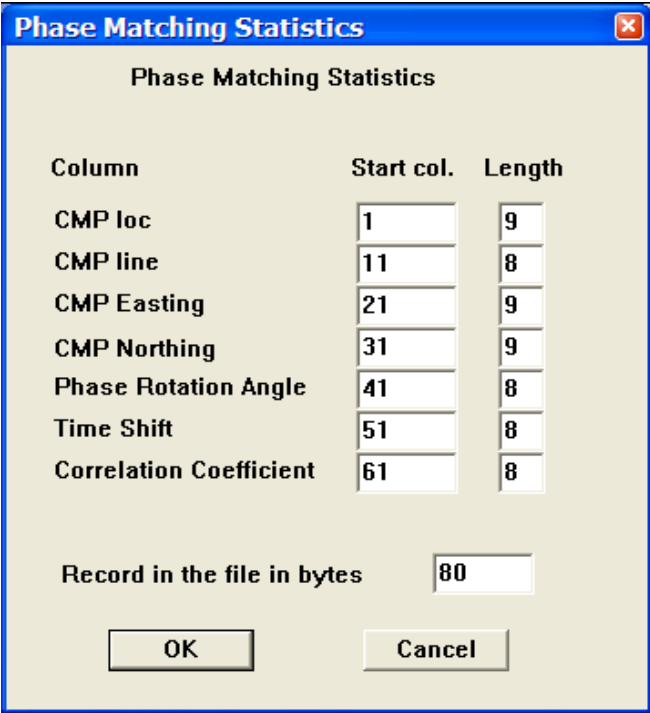
Customize Browse

OK Cancel

Example Card Data:

Phase Matching Statistics							
		Add Row Del Row		Cell Math			
	CMP Location	CMP Line	CMP Easting	CMP Northing	User Def 1	User Def 2	User Def 3
1	1.500000	101	100400.000000	100100.000000	30.000000	-16.000000	1.000000
2	2.000000	101	100375.000000	100125.000000	30.000000	-16.000000	1.000000
3	2.500000	101	100350.000000	100150.000000	30.000000	-16.000000	1.000000
4	3.000000	101	100325.000000	100175.000000	30.000000	-16.000000	1.000000
5	3.500000	101	100300.000000	100200.000000	30.000000	-16.000000	1.000000
6	4.000000	101	100275.000000	100225.000000	30.000000	-16.000000	1.000000
7	4.500000	101	100250.000000	100250.000000	30.000000	-16.000000	1.000000
8	5.000000	101	100225.000000	100275.000000	30.000000	-16.000000	1.000000
9	5.500000	101	100200.000000	100300.000000	30.000000	-16.000000	1.000000
10	6.000000	101	100175.000000	100325.000000	30.000000	-16.000000	1.000000
11	6.500000	101	100150.000000	100350.000000	30.000000	-16.000000	1.000000

Card Data Customization Parameter Dialog:



The dialog box is titled "Phase Matching Statistics" and contains a table for configuring data columns. The table has three columns: "Column", "Start col.", and "Length". The rows are: "CMP loc" (Start col. 1, Length 9), "CMP line" (Start col. 11, Length 8), "CMP Easting" (Start col. 21, Length 9), "CMP Northing" (Start col. 31, Length 9), "Phase Rotation Angle" (Start col. 41, Length 8), "Time Shift" (Start col. 51, Length 8), and "Correlation Coefficient" (Start col. 61, Length 8). Below the table is a field "Record in the file in bytes" with the value 80. At the bottom are "OK" and "Cancel" buttons.

Column	Start col.	Length
CMP loc	1	9
CMP line	11	8
CMP Easting	21	9
CMP Northing	31	9
Phase Rotation Angle	41	8
Time Shift	51	8
Correlation Coefficient	61	8

Record in the file in bytes: 80

OK Cancel

Parameter descriptions:

CMP loc — Enter the start column and the number of columns allocated to write the CMP Location number.

CMP line — Enter the start column and the number of columns allocated to write the CMP Line number.

CMP Easting — Enter the start column and the number of columns allocated to write the CMP Easting.

CMP Northing — Enter the start column and the number of columns allocated to write the CMP Northing.

Phase Rotation Angle — Enter the start column and the number of columns allocated to write the Phase Rotation Angle.

Time Shift — Enter the start column and the number of columns allocated to write the Time Shift.

Correlation Coefficient — Enter the start column and the number of columns allocated to write the Correlation Coefficient.

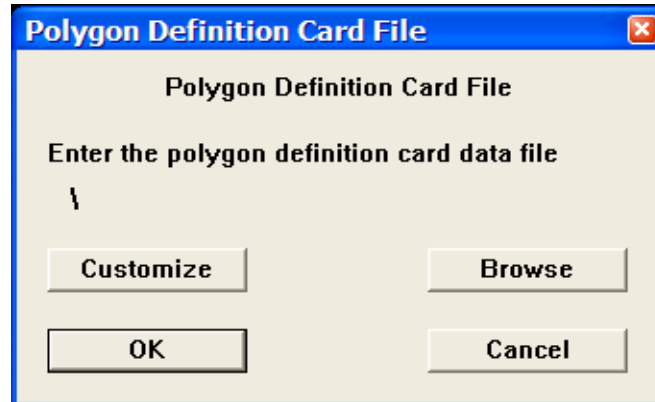
Record in the file in bytes – Enter the length in bytes of one line of the Phase Matching Statistics file.

Polygon Definition File

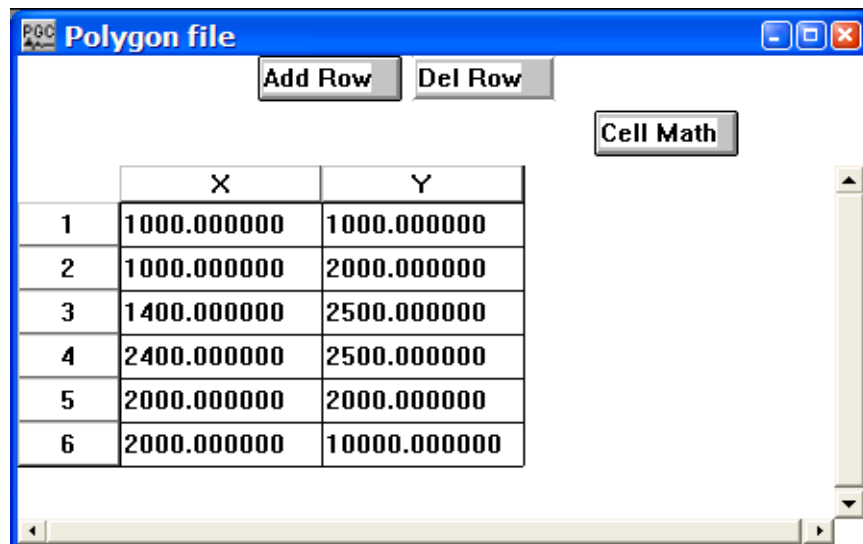
Usage:

The Polygon Definition File card data item is used to specify the coordinates of a polygon that will be used to select data from a seismic volume. The Polygon Definition File may be used to selectively input data in conjunction with the SPW Tape Utility or may be linked to the Select Traces processing step for the same purpose.

Step Parameter Dialog:



Example Card Data:



Card Data Customization Parameter Dialog:

Polygon Definition

Customize Polygon Definition File Format

No. of comment records preceeding data

File header field	Start column	Length
Number of rows	<input type="text" value="1"/>	<input type="text" value="9"/>

Data header field	Start column	Length
X (first key value)	<input type="text" value="1"/>	<input type="text" value="9"/>
Y (second key value)	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of coordinate pairs used to define the polygon in the output polygon definition file.

Data header field:

X (first key value) — Enter the start column and the number of columns allocated to write the X coordinate associated with a given coordinate pair in the output polygon definition file.

Y (second key value) — Enter the start column and the number of columns allocated to write the Y coordinate associated with a given coordinate pair in the output polygon definition file.

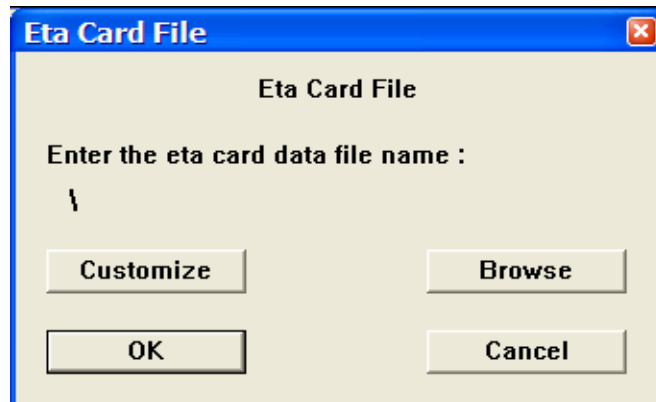
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the polygon definition file.

PP Nhmo Eta Function

Usage:

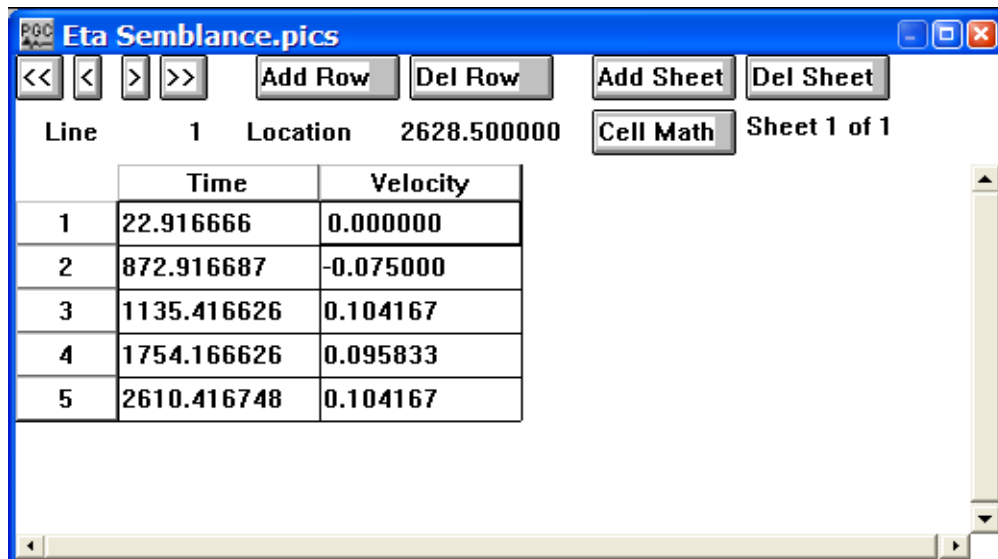
The PP Nhmo Eta Function card data item is used to store time-eta pairs for the case of P-wave non-hyperbolic moveout, where Eta is a parameter that characterizes the anisotropy in transversely isotropic media. Once the short-spread P-wave stacking velocity function has been picked, corresponding Eta functions may be picked interactively in SeisViewer on Eta Semblance gathers. The PP Nhmo Eta Function card has the same structure as a Velocity Function card.

Step Parameter Dialog:



The dialog box is titled "Eta Card File" and contains a text input field with the label "Enter the eta card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window displays a table of data with columns "Time" and "Velocity". The table has 5 rows of data. Above the table, there are navigation buttons: "<<", "<", ">", ">>". To the right of the table, there are buttons: "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar at the bottom indicates "Sheet 1 of 1".

Line	1	Location	2628.500000
	Time	Velocity	
1	22.916666	0.000000	
2	872.916687	-0.075000	
3	1135.416626	0.104167	
4	1754.166626	0.095833	
5	2610.416748	0.104167	

Card Data Customization Parameter Dialog:

Customize Velocity

Customize Velocity File Format

Number of comment records preceding data

File header field	Start column	Length
No. of velocity locations [sheets]	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Time	<input type="text" value="1"/>	<input type="text" value="9"/>
Velocity	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of velocity locations — Enter the start column and the number of columns allocated to write the number of velocity locations in the velocity file.

Sheet header field:

CMP line number — Enter the start column and the number of columns allocated to write the CMP line number associated with a velocity function in the velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a velocity function in the velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the CMP locations per CMP line in the velocity file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the two-way travel time (in milliseconds) associated with a given velocity pick in the velocity file.

Velocity — Enter the start column and the number of columns allocated to write the RMS or interval velocity value associated with a given velocity pick in the velocity file.

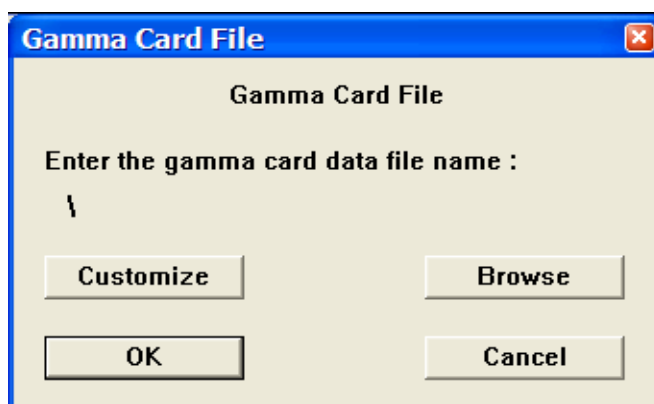
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the PP NMO eta function file.

PP Nhmo Gamma Function

Usage:

The PP Nhmo Gamma Function card data item is used to store time-gamma pairs for the case of PS-wave (i.e. converted wave) non-hyperbolic moveout, where Gamma is the effective V_p/V_s ratio down to the event being analyzed. Once the short-spread P-wave stacking velocity function has been picked, corresponding Gamma functions may be picked interactively in SeisViewer on Gamma Semblance gathers. The PP Nhmo Gamma Function card has the same structure as a Velocity Function card.

Step Parameter Dialog:



Example Card Data:

The window is titled "Gamma Semblance.pics". It has a toolbar with buttons: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar shows "Sheet 1 of 1". The main area contains a table with the following data:

Line	1	Location	2648.500000
	Time	Velocity	
1	32.000000	2.364583	
2	981.333313	2.364583	
3	1401.333374	2.427083	
4	1717.333374	2.718750	
5	2056.000000	2.458333	
6	2262.666748	2.250000	
7	2502.666748	1.864583	

Card Data Customization Parameter Dialog:

Customize Velocity

Customize Velocity File Format

Number of comment records preceding data

File header field

	Start column	Length
No. of velocity locations (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field

	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field

	Start column	Length
Time	<input type="text" value="1"/>	<input type="text" value="9"/>
Velocity	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of velocity locations — Enter the start column and the number of columns allocated to write the number of velocity locations in the velocity file.

Sheet header field:

CMP line number — Enter the start column and the number of columns allocated to write the CMP line number associated with a velocity function in the velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a velocity function in the velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the CMP locations per CMP line in the velocity file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the two-way travel time (in milliseconds) associated with a given velocity pick in the velocity file.

Velocity — Enter the start column and the number of columns allocated to write the RMS or interval velocity value associated with a given velocity pick in the velocity file.

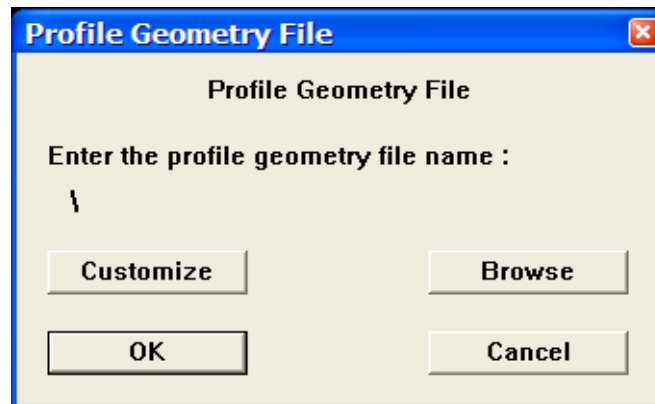
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the PP NHMO gamma function file.

Profile Geometry File

Usage:

The Profile Geometry File card data item is used to store the profile (single fold or radar data) information used in conjunction with the Single Fold Profile Geometry step to update trace headers with survey geometry information.

Step Parameter Dialog:



Profile Geometry File

Profile Geometry File

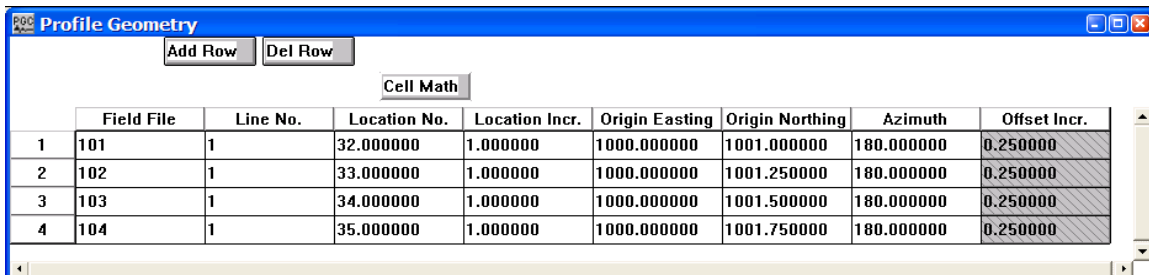
Enter the profile geometry file name :

\

Customize Browse

OK Cancel

Example Card Data:



	Field File	Line No.	Location No.	Location Incr.	Origin Easting	Origin Northing	Azimuth	Offset Incr.
1	101	1	32.000000	1.000000	1000.000000	1001.000000	180.000000	0.250000
2	102	1	33.000000	1.000000	1000.000000	1001.250000	180.000000	0.250000
3	103	1	34.000000	1.000000	1000.000000	1001.500000	180.000000	0.250000
4	104	1	35.000000	1.000000	1000.000000	1001.750000	180.000000	0.250000

Card Data Customization Parameter Dialog:

Data header field	Start column	Length
Field file number	1	9
CMP Line	11	9
CMP Location	21	9
CMP Location increment	31	9
Origin Easting	41	10
Origin Northing	51	10
Azimuth in degrees	61	9
Offset increment	71	9

Parameter descriptions:

Number of comment records preceding data: — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

Data header field:

Field file number — Enter the start column and the number of columns allocated to write the field file number associated with a given record in the profile geometry file.

CMP Line — Enter the start column and the number of columns allocated to write the CMP line number associated with a given record in the profile geometry file.

CMP Location — Enter the start column and the number of columns allocated to write the CMP location number associated with a given record in the profile geometry file.

CMP Location increment — Enter the start column and the number of columns allocated to write the increment between CMP location numbers associated with a given record in the profile geometry file.

Origin Easting — Enter the start column and the number of columns allocated to write the easting of the coordinate pair associated with the survey origin for the given record in the profile geometry file.

Origin Northing — Enter the start column and the number of columns allocated to write the northing of the coordinate pair associated with the survey origin for the given record in the profile geometry file.

Azimuth in degrees — Enter the start column and the number of columns allocated to write the source-origin azimuth associated with a given record in the profile geometry file.

Offset increment — Enter the start column and the number of columns allocated to write the source-receiver offset increment associated with a given record in the profile geometry file.

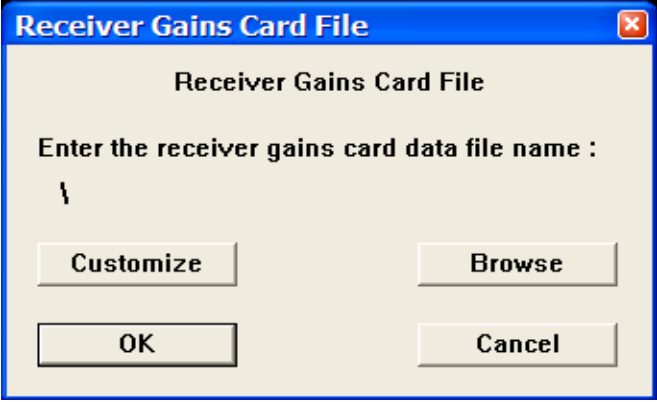
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the profile geometry file.

Receiver Gains

Usage:

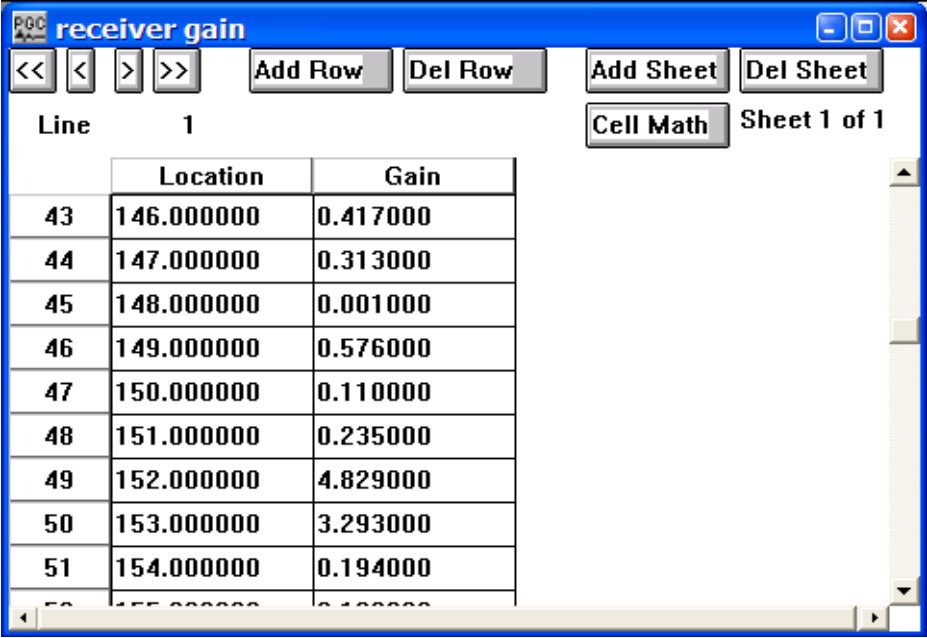
The Receiver Gains card data item is used to store surface consistent gains associated with receiver locations.

Step Parameter Dialog:



The dialog box is titled "Receiver Gains Card File". It contains a text input field with the label "Enter the receiver gains card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window is titled "receiver gain". It features a toolbar with navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar indicates "Sheet 1 of 1". The data is presented in a table with columns "Line", "Location", and "Gain".

Line	Location	Gain
43	146.000000	0.417000
44	147.000000	0.313000
45	148.000000	0.001000
46	149.000000	0.576000
47	150.000000	0.110000
48	151.000000	0.235000
49	152.000000	4.829000
50	153.000000	3.293000
51	154.000000	0.194000

Card Data Customization Parameter Dialog:

Customize Receiver Gains

Customize Receiver Gains

No. of comment records preceeding data

File header field

	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field

	Start column	Length
Receiver line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field

	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Gain	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of receiver lines in the receiver gain file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write the receiver line number in the output receiver gain file.

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver positions per receiver line in the output receiver gain file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the receiver location number in the receiver gain file.

Gain — Enter the start column and the number of columns allocated to write the receiver gain in the receiver gain file.


Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the receiver gains file.

Receiver Locations – SPS Format

Usage:

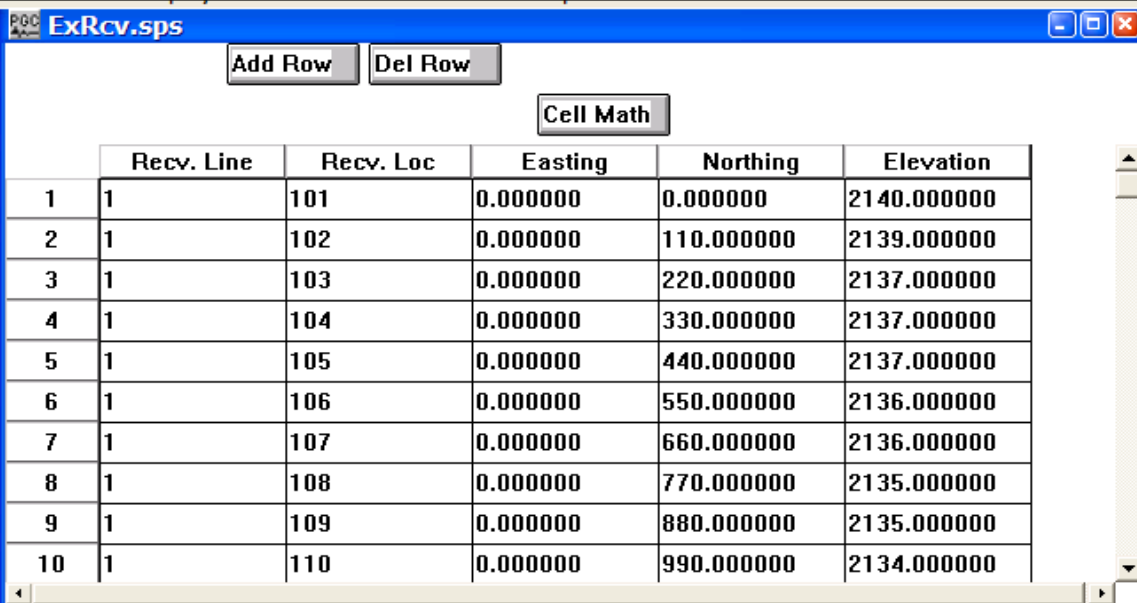
The Receiver Locations – SPS Format card data item is used to store positional receiver location information. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).

Step Parameter Dialog:



The dialog box is titled "Receiver SPS Format File" and contains a text input field with the label "Enter the receiver SPS file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window titled "ExRcv.sps" displays a table with 6 columns: "Recv. Line", "Recv. Loc", "Easting", "Northing", and "Elevation". The table contains 10 rows of data. Above the table are buttons for "Add Row", "Del Row", and "Cell Math".

	Recv. Line	Recv. Loc	Easting	Northing	Elevation
1	1	101	0.000000	0.000000	2140.000000
2	1	102	0.000000	110.000000	2139.000000
3	1	103	0.000000	220.000000	2137.000000
4	1	104	0.000000	330.000000	2137.000000
5	1	105	0.000000	440.000000	2137.000000
6	1	106	0.000000	550.000000	2136.000000
7	1	107	0.000000	660.000000	2136.000000
8	1	108	0.000000	770.000000	2135.000000
9	1	109	0.000000	880.000000	2135.000000
10	1	110	0.000000	990.000000	2134.000000

Card Data Customization Parameter Dialog:

Column	Load	Start col.	Length	Implied decimal	Digits after decimal
Line	<input checked="" type="checkbox"/>	2	3	<input type="checkbox"/>	0
Location	<input checked="" type="checkbox"/>	18	8	<input type="checkbox"/>	0
Lat	<input type="checkbox"/>	56	10	<input type="checkbox"/>	1
Long	<input type="checkbox"/>	47	9	<input type="checkbox"/>	1
Easting	<input checked="" type="checkbox"/>	47	9	<input type="checkbox"/>	1
Northing	<input checked="" type="checkbox"/>	56	10	<input type="checkbox"/>	1
Elevation	<input checked="" type="checkbox"/>	66	6	<input type="checkbox"/>	1
Static	<input type="checkbox"/>	29	4	<input type="checkbox"/>	0
Depth	<input type="checkbox"/>	33	4	<input type="checkbox"/>	1
Datum	<input type="checkbox"/>	37	4	<input type="checkbox"/>	0
Up hole	<input type="checkbox"/>	41	2	<input type="checkbox"/>	0
Water depth	<input type="checkbox"/>	43	4	<input type="checkbox"/>	1
Date	<input type="checkbox"/>	72	3	<input type="checkbox"/>	0
Time	<input type="checkbox"/>	75	6	<input type="checkbox"/>	0

☐ 'R' or 'S' record id present in column 1

Enter the length of each record in the file in bytes

OK Cancel

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Line — Enter the start column and the number of columns allocated to write the receiver line associated with a given record in the Receiver SPS file.

Location — Enter the start column and the number of columns allocated to write the receiver location associated with a given record in the Receiver SPS file.

Latitude — Enter the start column and the number of columns allocated to write the receiver latitude associated with a given record in the Receiver SPS file.

Longitude — Enter the start column and the number of columns allocated to write the receiver longitude associated with a given record in the Receiver SPS file.

Easting — Enter the start column and the number of columns allocated to write the receiver easting associated with a given record in the Receiver SPS file.

Northing — Enter the start column and the number of columns allocated to write the receiver northing associated with a given record in the Receiver SPS file.

Elevation — Enter the start column and the number of columns allocated to write the receiver elevation associated with a given record in the Receiver SPS file.

Static — Enter the start column and the number of columns allocated to write the receiver static associated with a given record in the Receiver SPS file.

Depth — Enter the start column and the number of columns allocated to write the receiver depth associated with a given record in the Receiver SPS file.

Datum — Enter the start column and the number of columns allocated to write the elevation of the datum at a receiver station associated with a given record in the Receiver SPS file.

Uphole — Enter the start column and the number of columns allocated to write the interpolated uphole time (ms) at a receiver station associated with a given record in the Receiver SPS file.

Water depth — Enter the start column and the number of columns allocated to write the water depth at a receiver station associated with a given record in the Receiver SPS file.

Date — Enter the start column and the number of columns allocated to write the Julian day on which the receiver station was initially deployed in the Receiver SPS file.

Time — Enter the start column and the number of columns allocated to write the time of day on which the receiver station was initially deployed in the Receiver SPS file.

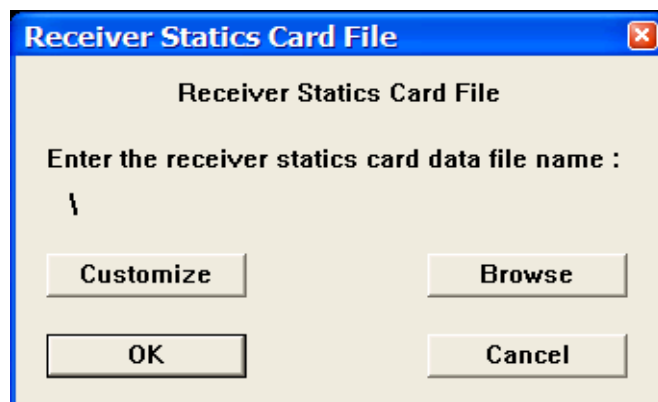
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS receiver file.

Receiver Statics

Usage:

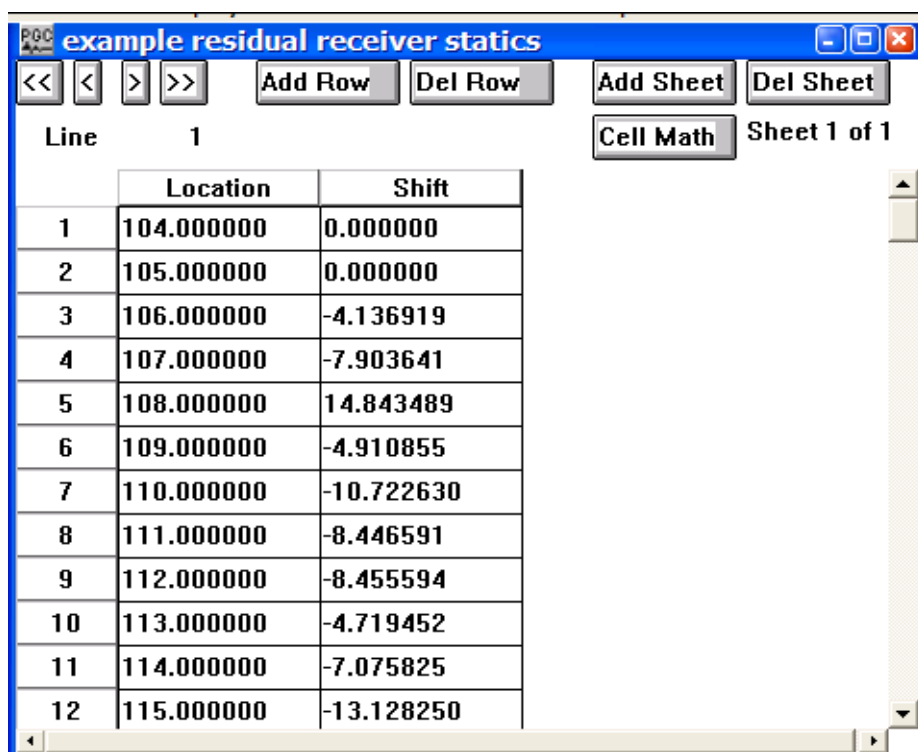
The Receiver Statics card data item is used to store receiver static information in units of milliseconds.

Step Parameter Dialog:



The dialog box is titled "Receiver Statics Card File". It contains a text input field with the label "Enter the receiver statics card data file name :". The input field contains a backslash character. Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window is titled "example residual receiver statics". It features a toolbar with navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The main area displays a table with 12 rows and 3 columns. The first column is labeled "Line" and contains numbers 1 through 12. The second column is labeled "Location" and contains values from 104.000000 to 115.000000. The third column is labeled "Shift" and contains values from 0.000000 to -13.128250. The window also shows "Sheet 1 of 1" and a "Cell Math" button.

Line	Location	Shift
1	104.000000	0.000000
2	105.000000	0.000000
3	106.000000	-4.136919
4	107.000000	-7.903641
5	108.000000	14.843489
6	109.000000	-4.910855
7	110.000000	-10.722630
8	111.000000	-8.446591
9	112.000000	-8.455594
10	113.000000	-4.719452
11	114.000000	-7.075825
12	115.000000	-13.128250

Card Data Customization Parameter Dialog:

Customize Receiver Statics

Number of comment records preceeding data

File header field	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Receiver line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="11"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Time	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of receiver lines in the receiver statics file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write the receiver line number in the output receiver statics file.

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver positions per receiver line in the output receiver statics file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the receiver location number in the receiver statics file.

Time — Enter the start column and the number of columns allocated to write the receiver static (in milliseconds) in the receiver static file.

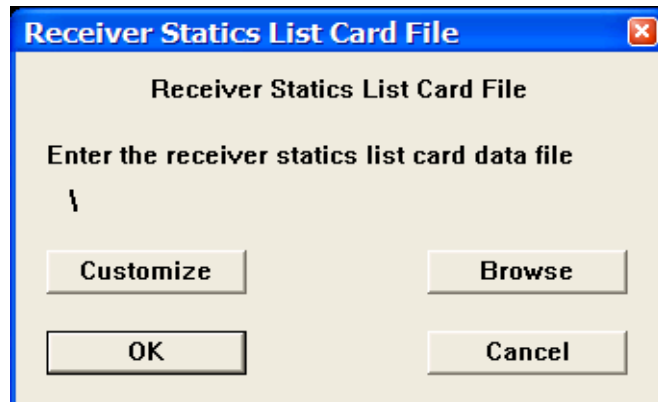
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the receiver statics file.

Receiver Statics List

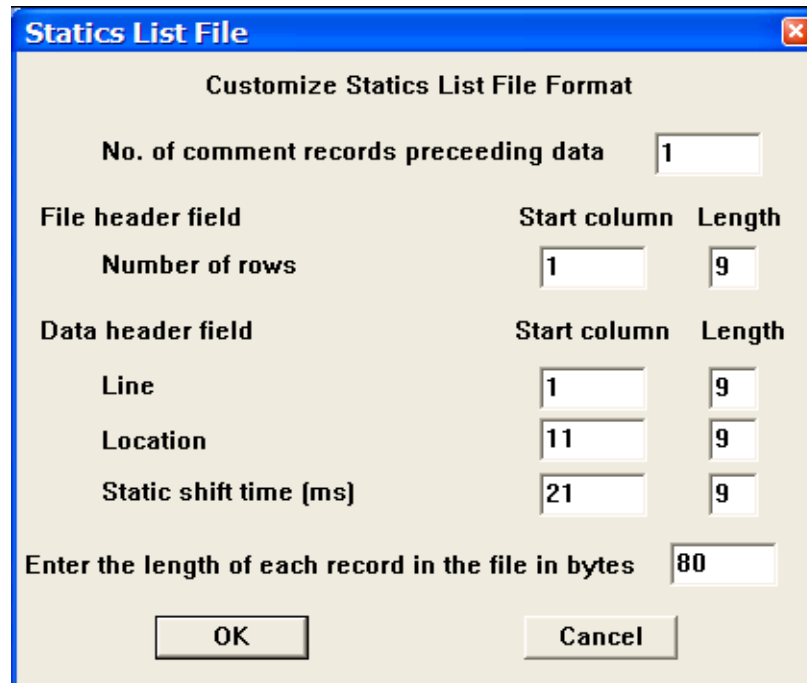
Usage:

The Receiver Statics List card data item is used to store receiver static information received in a foreign text format.

Step Parameter Dialog:



Card Data Customization Parameter Dialog:



The dialog box is titled "Statics List File" and contains the text "Customize Statics List File Format". It has several input fields for configuring the file format. The "No. of comment records preceeding data" field is set to 1. The "File header field" section has a "Number of rows" field set to 1. The "Data header field" section has three rows: "Line" with start column 1 and length 9, "Location" with start column 11 and length 9, and "Static shift time (ms)" with start column 21 and length 9. At the bottom, the "Enter the length of each record in the file in bytes" field is set to 80. There are "OK" and "Cancel" buttons at the bottom.

Field	Start column	Length
No. of comment records preceeding data	1	
File header field		
Number of rows	1	9
Data header field		
Line	1	9
Location	11	9
Static shift time (ms)	21	9
Enter the length of each record in the file in bytes		80

Parameter descriptions:

Number of comment records preceding data — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver stations in the receiver statics list file.

Data Header field:

Line — Enter the start column and the number of columns allocated to write the receiver line number in the output receiver statics list file.

Location — Enter the start column and the number of columns allocated to write the receiver location number in the output receiver statics list file.

Static shift time (ms) — Enter the start column and the number of columns allocated to write the receiver static shift in the output receiver statics list file.

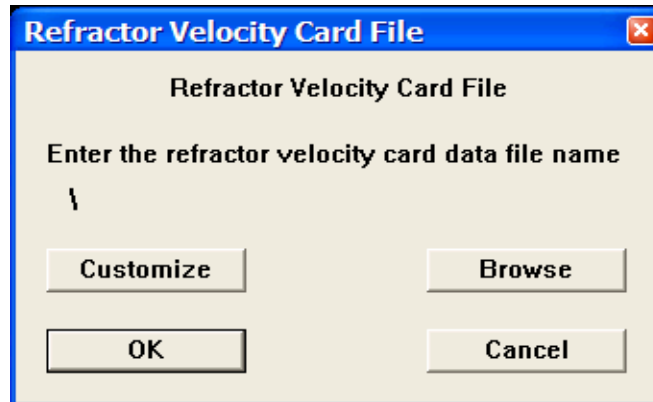
Enter the length of each record in the file in bytes — Enter the length in bytes of one line of the receiver statics list file.

Refractor Velocities

Usage:

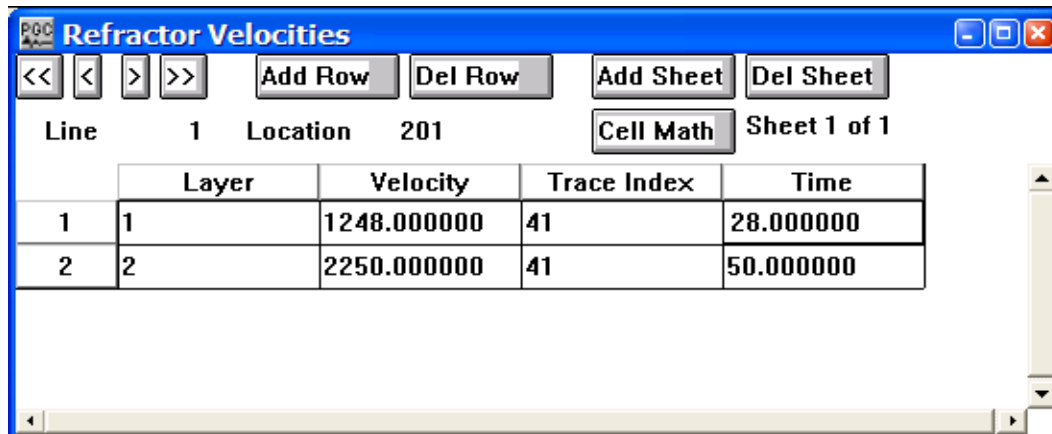
The Refractor Velocity card data item is used to store laterally varying refractor velocities. These velocities may be picked interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



A dialog box titled "Refractor Velocity Card File" with a close button (X) in the top right corner. The main text says "Enter the refractor velocity card data file name". Below this is a text input field containing a backslash character (\). There are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



A window titled "Refractor Velocities" with a toolbar containing navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". Below the toolbar, it shows "Line 1 Location 201" and "Sheet 1 of 1". The main area contains a table with 5 columns: Layer, Velocity, Trace Index, and Time. The first two columns are also labeled "Line" and "Location".

Line	Location	Layer	Velocity	Trace Index	Time
1	1		1248.000000	41	28.000000
2	2		2250.000000	41	50.000000

Card Data Customization Parameter Dialog:

Customize Refractor Velocity

Customize Refractor Velocity File Format

Number of comment records preceeding data

File header field	Start column	Length
No. of velocity locations [sheets]	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Layer	<input type="text" value="1"/>	<input type="text" value="9"/>
Velocity	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of velocity locations — Enter the start column and the number of columns allocated to write the number of refractor velocity locations in the refractor velocity file.

Sheet Header field:

CMP line number— Enter the start column and the number of columns allocated to write the CMP line number associated with a specified refractor velocity in the output refractor velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a specified refractor velocity in the output refractor velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP location per CMP line in the output refractor velocity file.

Data Header field:

Layer — Enter the start column and the number of columns allocated to write the layer associated with a specified refractor velocity value in the output refractor velocity file.

Velocity — Enter the start column and the number of columns allocated to write the velocity associated with a specified layer and location in the output refractor velocity file.

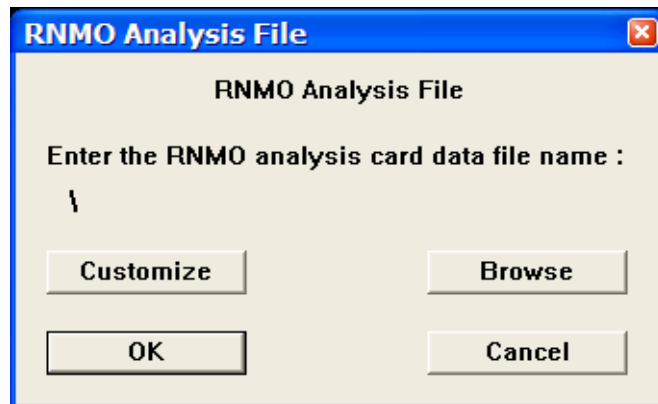
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the refractor velocities file.

Residual NMO Analysis

Usage:

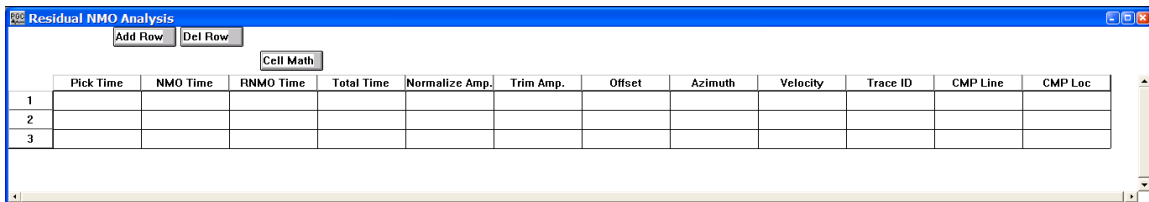
The Residual NMO card data item is used to store residual NMO velocity information. These velocities may be picked interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



The dialog box is titled "RNMO Analysis File". It contains a text input field with the label "Enter the RNMO analysis card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

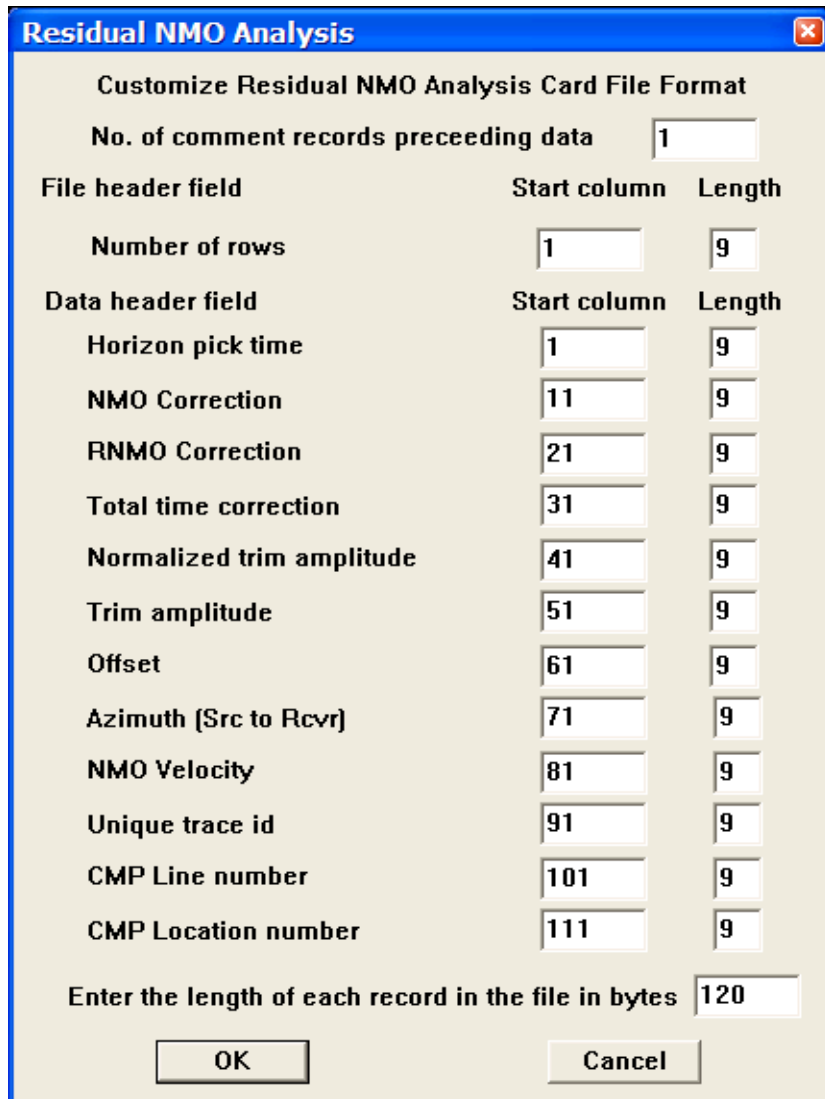
Example Card Data:



The window is titled "Residual NMO Analysis". It has buttons for "Add Row", "Del Row", and "Cell Math". Below these buttons is a table with 13 columns: "Pick Time", "NMO Time", "RNMO Time", "Total Time", "Normalize Amp.", "Trim Amp.", "Offset", "Azimuth", "Velocity", "Trace ID", "CMP Line", and "CMP Loc". The table has 3 rows, numbered 1, 2, and 3.

	Pick Time	NMO Time	RNMO Time	Total Time	Normalize Amp.	Trim Amp.	Offset	Azimuth	Velocity	Trace ID	CMP Line	CMP Loc
1												
2												
3												

Card Data Customization Parameter Dialog:



The dialog box is titled "Residual NMO Analysis" and contains the following fields and controls:

- Customize Residual NMO Analysis Card File Format**
- No. of comment records preceeding data:** 1
- File header field:**
 - Number of rows:** Start column: 1, Length: 9
- Data header field:**
 - Horizon pick time:** Start column: 1, Length: 9
 - NMO Correction:** Start column: 11, Length: 9
 - RNMO Correction:** Start column: 21, Length: 9
 - Total time correction:** Start column: 31, Length: 9
 - Normalized trim amplitude:** Start column: 41, Length: 9
 - Trim amplitude:** Start column: 51, Length: 9
 - Offset:** Start column: 61, Length: 9
 - Azimuth (Src to Rcvr):** Start column: 71, Length: 9
 - NMO Velocity:** Start column: 81, Length: 9
 - Unique trace id:** Start column: 91, Length: 9
 - CMP Line number:** Start column: 101, Length: 9
 - CMP Location number:** Start column: 111, Length: 9
- Enter the length of each record in the file in bytes:** 120
- OK** and **Cancel** buttons.

Parameter descriptions:

Number of comment records preceding data – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of refractor velocity locations in the refractor velocity file.

Sheet Header field:

CMP line number— Enter the start column and the number of columns allocated to write the CMP line number associated with a specified refractor velocity in the output refractor velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a specified refractor velocity in the output refractor velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP location per CMP line in the output refractor velocity file.

Data Header field:

Layer — Enter the start column and the number of columns allocated to write the layer associated with a specified refractor velocity value in the output refractor velocity file.

Velocity — Enter the start column and the number of columns allocated to write the velocity associated with a specified layer and location in the output refractor velocity file.

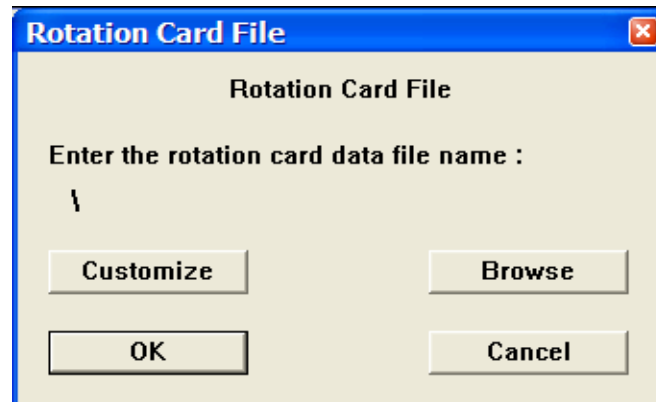
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the residual NMO analysis file.

Rotation Card File

Usage:

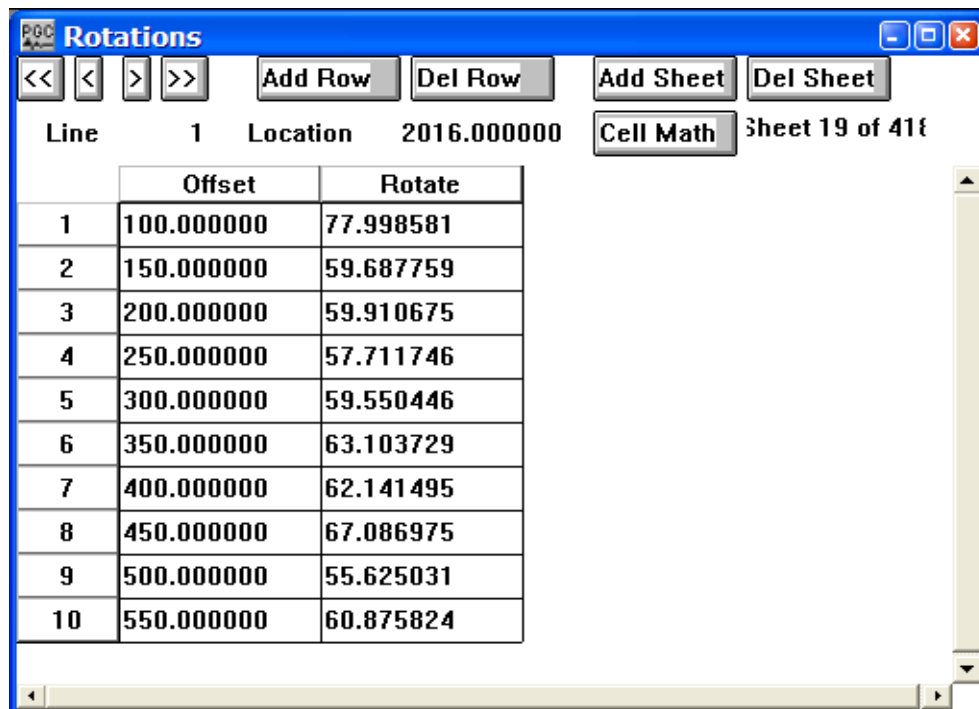
The Rotation Card File is used to store horizontal rotations output from the Two-Component Horizontal Rotation step in units of degrees.

Step Parameter Dialog:



The dialog box is titled "Rotation Card File" and contains a text input field with the label "Enter the rotation card data file name :". The input field contains a backslash character. Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The "Rotations" window displays a table with 10 rows of data. The table has three columns: "Line", "Offset", and "Rotate". The "Line" column contains values from 1 to 10. The "Offset" column contains values from 100.000000 to 550.000000 in increments of 50. The "Rotate" column contains values from 77.998581 to 60.875824. The window also includes navigation buttons at the top: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar at the bottom indicates "Sheet 19 of 41".

Line	Offset	Rotate
1	100.000000	77.998581
2	150.000000	59.687759
3	200.000000	59.910675
4	250.000000	57.711746
5	300.000000	59.550446
6	350.000000	63.103729
7	400.000000	62.141495
8	450.000000	67.086975
9	500.000000	55.625031
10	550.000000	60.875824

Card Data Customization Parameter Dialog:

Customize Rotate

Number of comment records preceding data: 1

File header field

	Start column	Length
Number of mute locations (sheets)	1	9

Sheet header field

	Start column	Length
CMP line number	1	9
CMP location number	11	9
Number of rows	21	9
Sort order	0	0

Data header field

	Start column	Length
Time	1	9
Offset	11	9
Unique trace number	0	0

Enter the length of each record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of receiver locations in the Rotation Card file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write the receiver line number in the output Rotation Card file.

CMP location number — Enter the start column and the number of columns allocated to write the receiver location number in the output Rotation Card file.

Number of rows — Enter the start column and the number of columns allocated to write the number of rotation estimates – one per source-receiver offset - in the output Rotation Card file.

Sort Order — Enter the start column and the number of columns allocated to write the sort order of the data.

Data header field:

Offset — Enter the start column and the number of columns allocated to write the source-receiver offset associated with the rotation estimate in the Rotation Card file.

Rotate — Enter the start column and the number of columns allocated to write the rotation estimate in the Rotation Card file.

Unique Trace Number — Enter the start column and the number of columns allocated to write the unique trace number associated with the estimated rotation in the Rotation Card file.

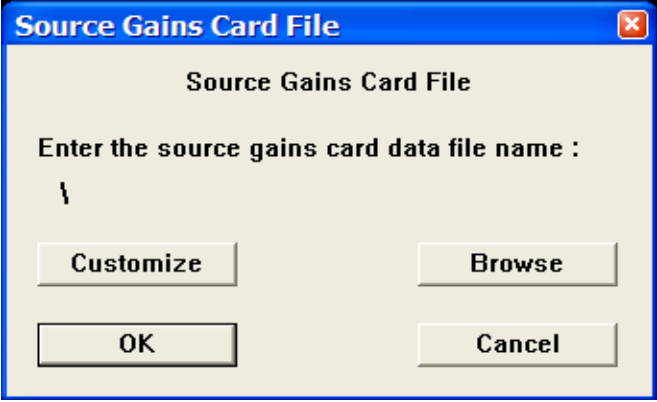
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the rotation card file.

Source Gains

Usage:

The Source Gains card data item is used to store gains associated with source locations.

Step Parameter Dialog:



A dialog box titled "Source Gains Card File" with a standard Windows window border. The title bar is blue with a red close button. The main area is light beige. It contains the text "Source Gains Card File" and "Enter the source gains card data file name :". Below this is a text input field containing a backslash character. At the bottom are four buttons: "Customize", "Browse", "OK", and "Cancel".

Source Gains Card File

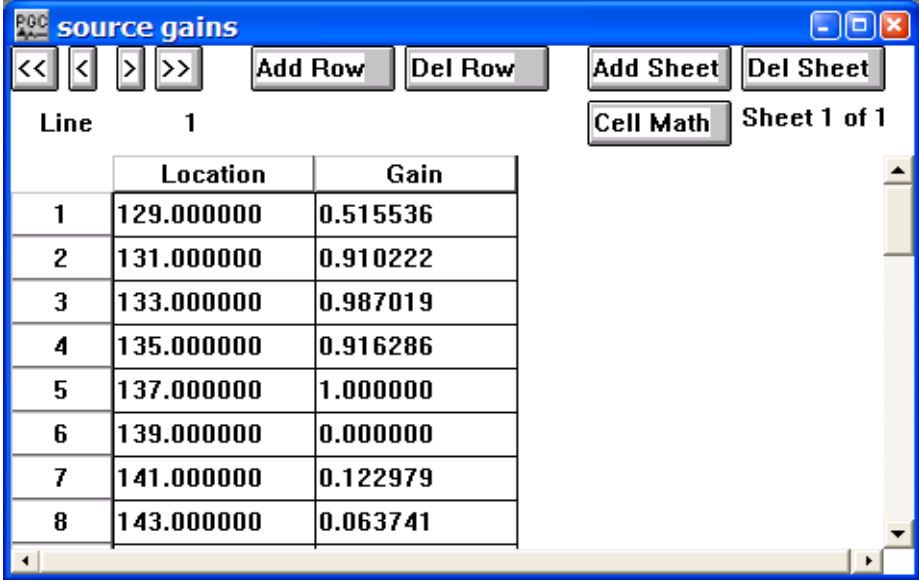
Enter the source gains card data file name :

\

Customize Browse

OK Cancel

Example Card Data:



A window titled "source gains" with a blue title bar and standard Windows window controls. It features a toolbar with navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". Below the toolbar, it shows "Line 1" and "Sheet 1 of 1". The main area contains a table with 3 columns: "Line", "Location", and "Gain". The table has 8 rows of data.

	Location	Gain
1	129.000000	0.515536
2	131.000000	0.910222
3	133.000000	0.987019
4	135.000000	0.916286
5	137.000000	1.000000
6	139.000000	0.000000
7	141.000000	0.122979
8	143.000000	0.063741

Card Data Customization Parameter Dialog:

Customize Source Gains

No. of comment records preceeding data

File header field	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Source line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Gain	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of source gain pairs in the source gain file.

Sheet Header field:

Source line number — Enter the start column and the number of columns allocated to write source line number in the output source gain file.

Number of rows — Enter the start column and the number of columns allocated to write the number of source positions per source line in the output source gain file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the source location number in the source gain file.

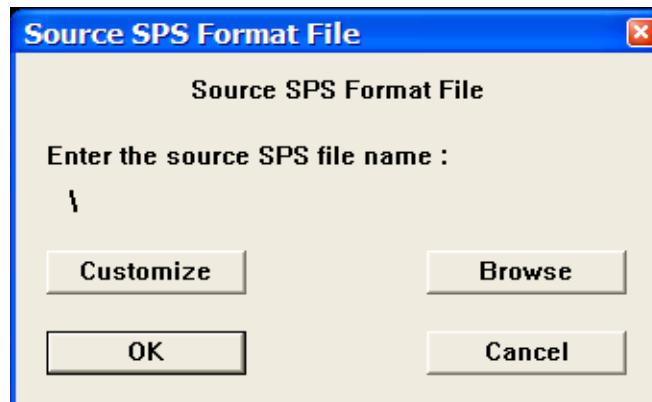
Gain — Enter the start column and the number of columns allocated to write the source gain in the source gain file.
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the source gains file.

Source Locations – SPS Format

Usage:

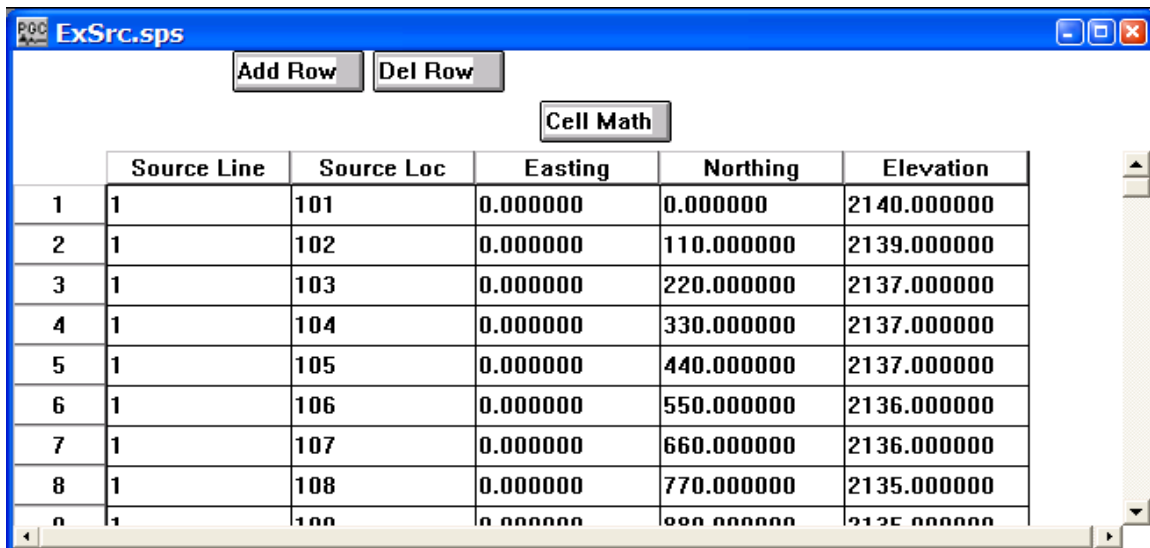
The Source Locations – SPW Format card data item is used to source location geometry information. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).

Step Parameter Dialog:



A dialog box titled "Source SPS Format File" with a close button (X) in the top right corner. The main text inside says "Source SPS Format File" and "Enter the source SPS file name :". Below this is a text input field containing a backslash character (\). At the bottom, there are four buttons: "Customize", "Browse", "OK", and "Cancel".

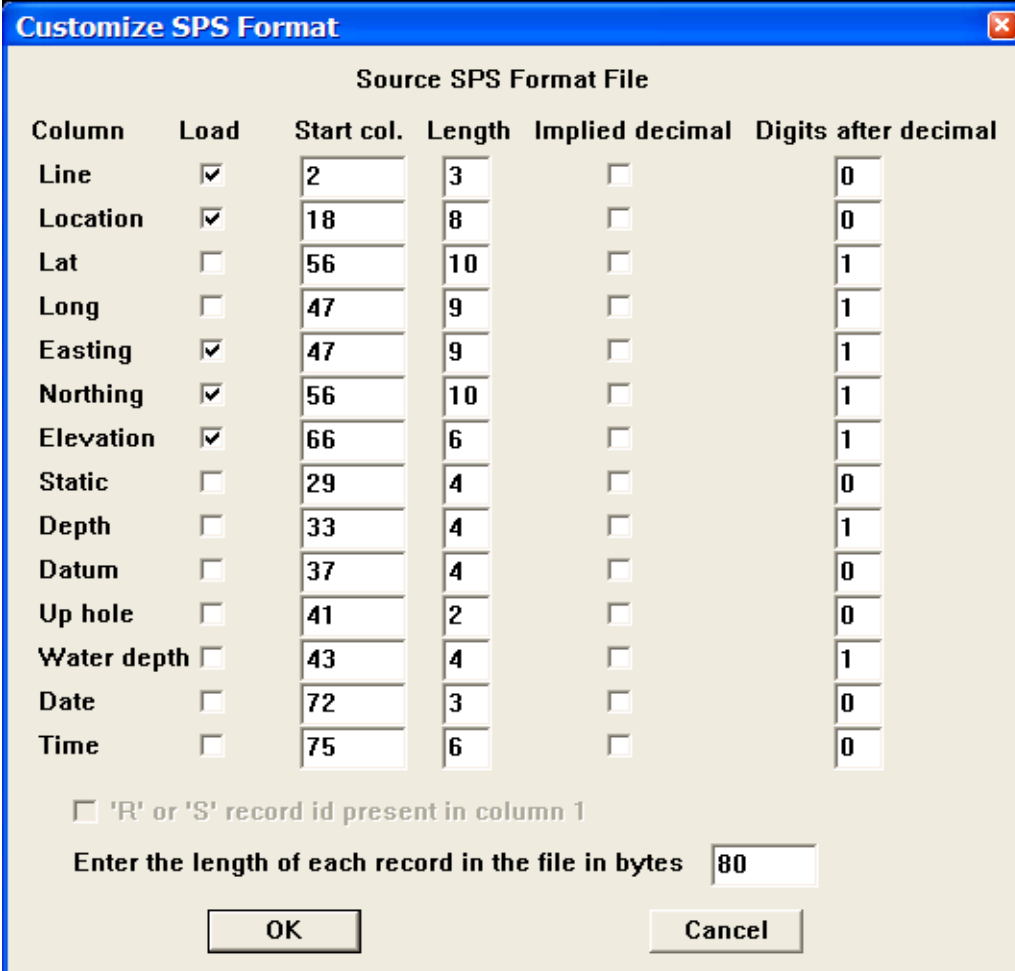
Example Card Data:



A screenshot of a software window titled "ExSrc.sps". It contains a table with 6 columns: "Source Line", "Source Loc", "Easting", "Northing", and "Elevation". The table has 9 rows of data. Above the table are three buttons: "Add Row", "Del Row", and "Cell Math".

	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	0.000000	0.000000	2140.000000
2	1	102	0.000000	110.000000	2139.000000
3	1	103	0.000000	220.000000	2137.000000
4	1	104	0.000000	330.000000	2137.000000
5	1	105	0.000000	440.000000	2137.000000
6	1	106	0.000000	550.000000	2136.000000
7	1	107	0.000000	660.000000	2136.000000
8	1	108	0.000000	770.000000	2135.000000
9	1	109	0.000000	880.000000	2135.000000

Card Data Customization Parameter Dialog:



The dialog box is titled "Customize SPS Format" and contains a table for configuring the "Source SPS Format File". The table has six columns: "Column", "Load", "Start col.", "Length", "Implied decimal", and "Digits after decimal". There are 14 rows of parameters. Below the table, there is a checkbox for "'R' or 'S' record id present in column 1", a text field for "Enter the length of each record in the file in bytes" with the value 80, and "OK" and "Cancel" buttons.

Column	Load	Start col.	Length	Implied decimal	Digits after decimal
Line	<input checked="" type="checkbox"/>	2	3	<input type="checkbox"/>	0
Location	<input checked="" type="checkbox"/>	18	8	<input type="checkbox"/>	0
Lat	<input type="checkbox"/>	56	10	<input type="checkbox"/>	1
Long	<input type="checkbox"/>	47	9	<input type="checkbox"/>	1
Easting	<input checked="" type="checkbox"/>	47	9	<input type="checkbox"/>	1
Northing	<input checked="" type="checkbox"/>	56	10	<input type="checkbox"/>	1
Elevation	<input checked="" type="checkbox"/>	66	6	<input type="checkbox"/>	1
Static	<input type="checkbox"/>	29	4	<input type="checkbox"/>	0
Depth	<input type="checkbox"/>	33	4	<input type="checkbox"/>	1
Datum	<input type="checkbox"/>	37	4	<input type="checkbox"/>	0
Up hole	<input type="checkbox"/>	41	2	<input type="checkbox"/>	0
Water depth	<input type="checkbox"/>	43	4	<input type="checkbox"/>	1
Date	<input type="checkbox"/>	72	3	<input type="checkbox"/>	0
Time	<input type="checkbox"/>	75	6	<input type="checkbox"/>	0

☐ 'R' or 'S' record id present in column 1

Enter the length of each record in the file in bytes

OK Cancel

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Line — Enter the start column and the number of columns allocated to write the source line associated with a given record in the Source SPS file.

Location — Enter the start column and the number of columns allocated to write the source location associated with a given record in the Source SPS file.

Latitude — Enter the start column and the number of columns allocated to write the source latitude associated with a given record in the Source SPS file.

Longitude — Enter the start column and the number of columns allocated to write the source longitude associated with a given record in the Source SPS file.

Easting — Enter the start column and the number of columns allocated to write the source easting associated with a given record in the Source SPS file.

Northing — Enter the start column and the number of columns allocated to write the source northing associated with a given record in the Source SPS file.

Elevation — Enter the start column and the number of columns allocated to write the source elevation associated with a given record in the Source SPS file.

Static — Enter the start column and the number of columns allocated to write the source static associated with a given record in the Source SPS file.

Depth — Enter the start column and the number of columns allocated to write the source depth associated with a given record in the Source SPS file.

Datum — Enter the start column and the number of columns allocated to write the elevation of the datum at the source station associated with a given record in the Source SPS file.

Uphole — Enter the start column and the number of columns allocated to write the uphole time (ms) at a source station associated with a given record in the Source SPS file.

Water depth — Enter the start column and the number of columns allocated to write the water depth at a source station associated with a given record in the Source SPS file.

Date — Enter the start column and the number of columns allocated to write the Julian day on which the source station was occupied in the Source SPS file.

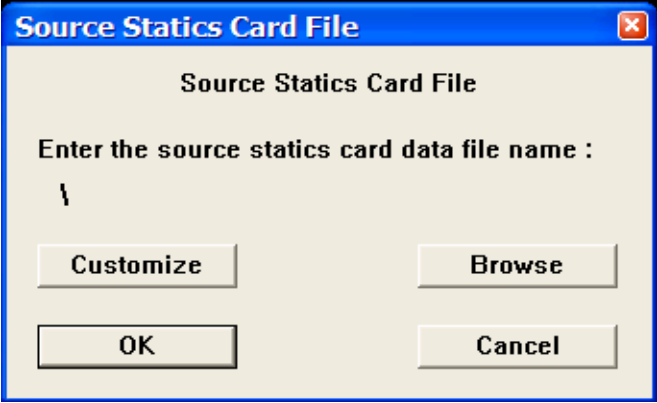
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS source file.

Source Statics

Usage:

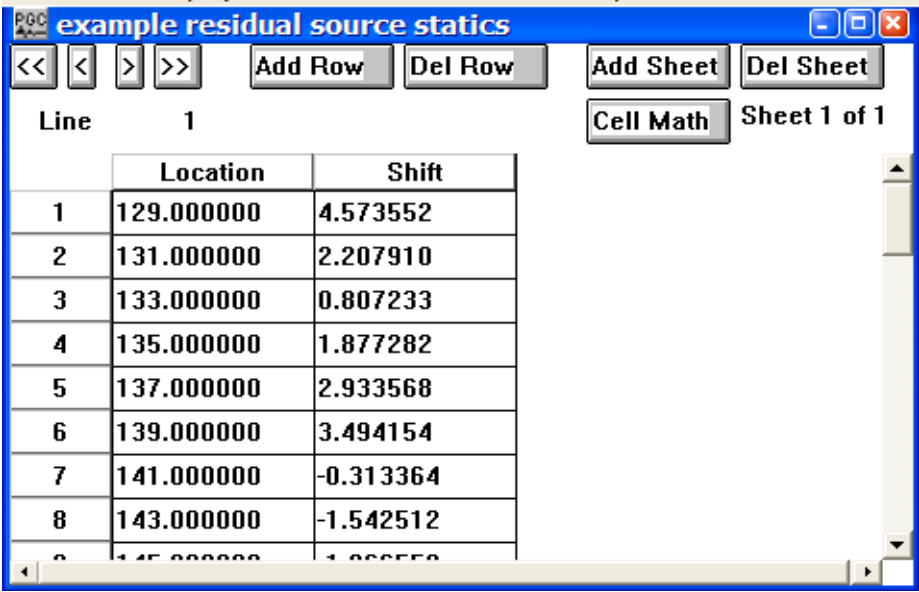
The Source Statics card data item is used to store source statics information in units of milliseconds.

Step Parameter Dialog:



A dialog box titled "Source Statics Card File" with a blue header bar. The main area is light gray and contains the text "Source Statics Card File" and "Enter the source statics card data file name :". Below this is a text input field containing a backslash character. At the bottom are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



A window titled "example residual source statics" with a blue header bar. It contains a toolbar with buttons: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". Below the toolbar, it says "Line 1" and "Sheet 1 of 1". The main area is a table with 3 columns: "Line", "Location", and "Shift".

Line	Location	Shift
1	129.000000	4.573552
2	131.000000	2.207910
3	133.000000	0.807233
4	135.000000	1.877282
5	137.000000	2.933568
6	139.000000	3.494154
7	141.000000	-0.313364
8	143.000000	-1.542512
9	145.000000	1.888558

Card Data Customization Parameter Dialog:

Customize Source Statics

Number of comment records preceeding data

File header field

	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field

	Start column	Length
Source line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="11"/>	<input type="text" value="9"/>

Data header field

	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Time	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of source lines in the source statics file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write source line number in the output source statics file.

Number of rows — Enter the start column and the number of columns allocated to write the number of source positions per source line in the output source statics file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the source location number in the source statics file.

Time — Enter the start column and the number of columns allocated to write the source static (in milliseconds) in the source static file.

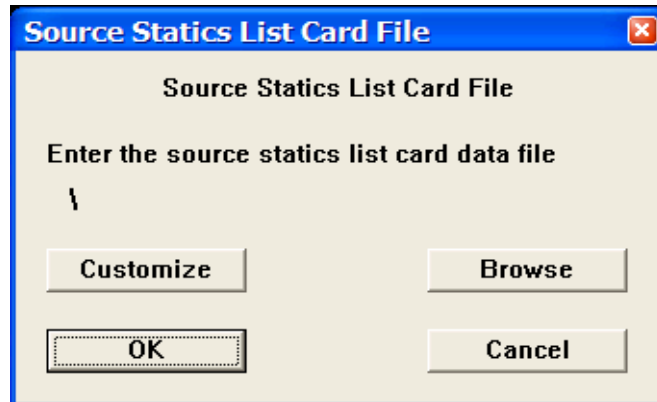
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the source statics file.

Source Statics List

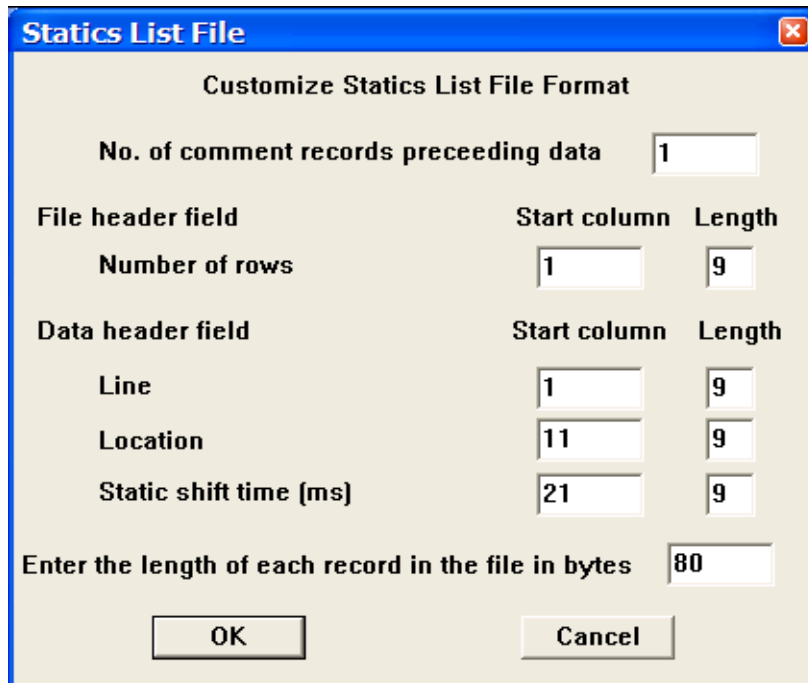
Usage:

The Source Statics card data item is used to store source static information received in a foreign format.

Step Parameter Dialog:



Card Data Customization Parameter Dialog:



The dialog box is titled "Statics List File" and contains a section titled "Customize Statics List File Format". It includes several input fields for configuring the file format:

Customize Statics List File Format		
No. of comment records preceeding data	<input type="text" value="1"/>	
File header field	Start column	Length
Number of rows	<input type="text" value="1"/>	<input type="text" value="9"/>
Data header field	Start column	Length
Line	<input type="text" value="1"/>	<input type="text" value="9"/>
Location	<input type="text" value="11"/>	<input type="text" value="9"/>
Static shift time (ms)	<input type="text" value="21"/>	<input type="text" value="9"/>
Enter the length of each record in the file in bytes	<input type="text" value="80"/>	

At the bottom, there are "OK" and "Cancel" buttons.

Parameter descriptions:

Number of comment records preceding data — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of source stations in the source statics list file.

Data Header field:

Line — Enter the start column and the number of columns allocated to write source line number in the output source statics list file.

Location — Enter the start column and the number of columns allocated to write the source location number in the output source statics list file.

Static shift time (ms) — Enter the start column and the number of columns allocated to write the source static shift in the output source statics list file.

Enter the length of each record in the file in bytes — Enter the length in bytes of one line of the source statics list file.

Card Data Customization Parameter Dialog:

Streamer Definition

Customize Streamer Definition File Format

Number of comment records preceeding data

Sheet header field	Start column	Length
Streamer number	<input type="text" value="1"/>	<input type="text" value="2"/>

Data header field	Start column	Length
First channel	<input type="text" value="6"/>	<input type="text" value="6"/>
Last channel	<input type="text" value="15"/>	<input type="text" value="6"/>
Receiver line	<input type="text" value="24"/>	<input type="text" value="8"/>
First receiver location	<input type="text" value="34"/>	<input type="text" value="8"/>
Receiver location increment	<input type="text" value="44"/>	<input type="text" value="6"/>
Distance between channels	<input type="text" value="54"/>	<input type="text" value="9"/>
Easting offset from origin	<input type="text" value="64"/>	<input type="text" value="9"/>
Northing offset from origin	<input type="text" value="74"/>	<input type="text" value="9"/>
Azimuth of stream (degrees)	<input type="text" value="84"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data — Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

Sheet Header field:

Streamer number — Enter the start column and the number of columns allocated to write the number of streamers in the streamer definition file.

Data Header field:

First channel — Enter the start column and the number of columns allocated to write the number of the first channel on the streamer in the streamer definition file.

Last channel — Enter the start column and the number of columns allocated to write the number of the last channel on the streamer in the streamer definition file.

Receiver line — Enter the start column and the number of columns allocated to write the number of the receiver line associated with a particular streamer number in the streamer definition file.

First receiver location — Enter the start column and the number of columns allocated to write the number of the first receiver location on the streamer in the streamer definition file.

Receiver location increment — Enter the start column and the number of columns allocated to write the increment between receiver numbers associated with each channel on the streamer in the streamer definition file.

Distance between channels — Enter the start column and the number of columns allocated to write the group interval associated with a group of channels on the streamer in the streamer definition file.

Easting offset from origin — Enter the start column and the number of columns allocated to write the easting offset distance from the survey origin for the first channel on the streamer in the streamer definition file.

Northing offset from origin — Enter the start column and the number of columns allocated to write the northing offset distance from the survey origin for the first channel on the streamer in the streamer definition file.

Azimuth of stream — Enter the start column and the number of columns allocated to write the streamer azimuth in the streamer definition file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the streamer definition file.

Surgical Mutes

Usage:

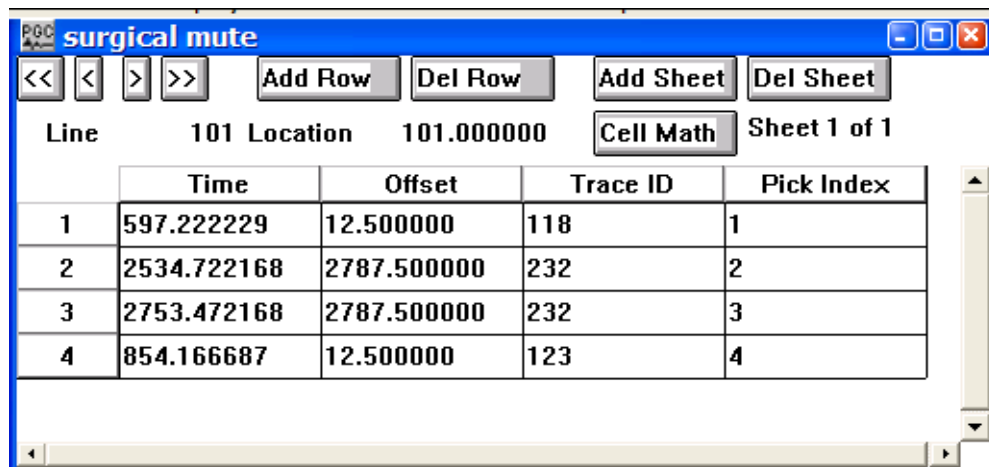
The Surgical Mutes card data item is used to store surgical mute data. Mute times are in units of seconds. Surgical mutes may be defined interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



The dialog box is titled "Surgical Mute Card File". It contains a text input field with the placeholder text "Enter the surgical mute card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window is titled "surgical mute". It features a toolbar with navigation buttons (<<, <, >, >>), "Add Row", "Del Row", "Add Sheet", and "Del Sheet". Below the toolbar, it displays "Line 101 Location 101.000000" and a "Cell Math" button. The main area is a table with 5 columns: "Line", "Time", "Offset", "Trace ID", and "Pick Index". The table contains 4 rows of data. A scrollbar is visible on the right side of the table.

Line	Time	Offset	Trace ID	Pick Index
1	597.222229	12.500000	118	1
2	2534.722168	2787.500000	232	2
3	2753.472168	2787.500000	232	3
4	854.166687	12.500000	123	4

Card Data Customization Parameter Dialog:

Customize Surgical Mute

Number of comment records preceding data: 1

File header field

Field	Start column	Length
Number of mute locations (sheets)	1	9

Sheet header field

Field	Start column	Length
CMP line number	1	9
CMP location number	11	9
Number of rows	21	9
Sort order	31	9

Data header field

Field	Start column	Length
Time	1	9
Offset	11	9
Unique trace number	21	9
Pick order index	31	9

Enter the length of each record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of mute locations — Enter the start column and the number of columns allocated to write the number of mute locations in the output mute file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write CMP line number in the output mute file.

CMP location number — Enter the start column and the number of columns allocated to write CMP location number in the output mute file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output mute file.

Sort — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the early mute was picked.

Data header field:

Time — Enter the start column and the number of columns allocated to write the mute time (in seconds) at a specified offset and trace number in the output mute file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset corresponding to a specified mute time and trace number in the output mute file.

Unique trace number — Enter the start column and the number of columns allocated to write the unique trace number corresponding to a specified mute time and source-receiver offset in the output mute file.

Pick order index — Enter the start column and the number of columns allocated to write the pick index corresponding to a specified mute time, source-receiver offset, and unique trace number in the output mute file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the surgical mute file.

Tail Mutes

Usage:

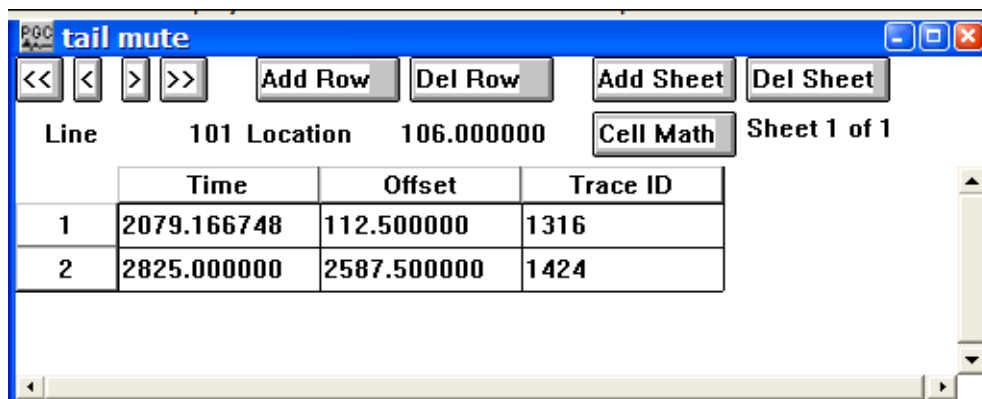
The Tail Mutes card data item is used to store tail or end mute data. Mute times are in units of seconds. Tail mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



The dialog box is titled "Tail Mute Card File" and contains a text input field with the label "Enter the tail mute card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window is titled "tail mute" and contains a table with the following data:

Line	Time	Offset	Trace ID
1	2079.166748	112.500000	1316
2	2825.000000	2587.500000	1424

Additional information displayed in the window includes "101 Location 106.000000", "Cell Math", and "Sheet 1 of 1".

Card Data Customization Parameter Dialog:

Customize Tail Mute

Number of comment records preceeding data: 1

File header field

	Start column	Length
Number of mute locations (sheets)	1	9

Sheet header field

	Start column	Length
CMP line number	1	9
CMP location number	11	9
Number of rows	21	9
Sort order	31	9

Data header field

	Start column	Length
Time	1	9
Offset	11	9
Unique trace number	21	9

Enter the length of each record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of mute locations — Enter the start column and the number of columns allocated to write the number of mute locations in the output mute file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write CMP line number in the output mute file.

CMP location number — Enter the start column and the number of columns allocated to write CMP location number in the output mute file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output mute file.

Sort — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the early mute was picked.

Data header field:

Time — Enter the start column and the number of columns allocated to write the mute time (in seconds) at a specified offset and trace number in the output mute file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset corresponding to a specified mute time and trace number in the output mute file.

Unique trace number — Enter the start column and the number of columns allocated to write the unique trace number corresponding to a specified mute time and source-receiver offset in the output mute file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the tail mute file.

Time Filter

Usage:

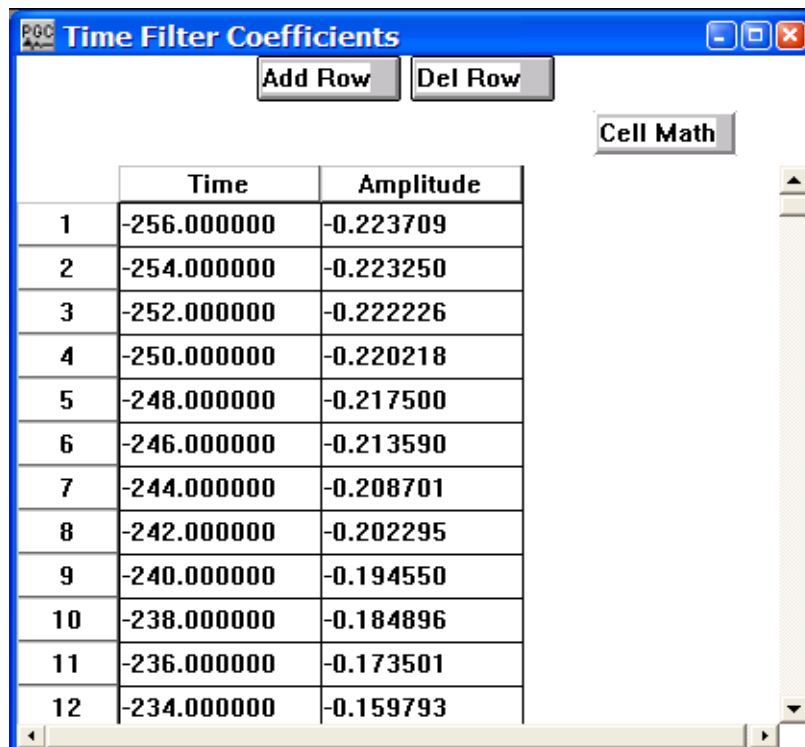
The Time Filter card data item is used to store the time-domain (impulse response) representation of a filter in units of milliseconds.

Step Parameter Dialog:



The dialog box is titled "Time 1D Filter Card File". It contains a text prompt "Enter the time 1D filter card data file name :" followed by a text input field containing a backslash character. Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

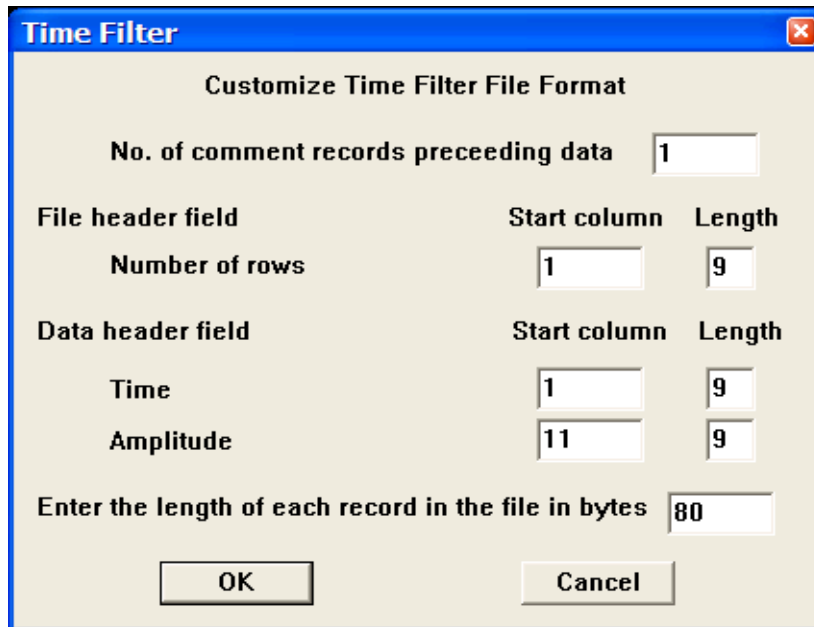
Example Card Data:



The window is titled "Time Filter Coefficients". It features a table with two columns: "Time" and "Amplitude". Above the table are buttons for "Add Row", "Del Row", and "Cell Math". The table contains 12 rows of data.

	Time	Amplitude
1	-256.000000	-0.223709
2	-254.000000	-0.223250
3	-252.000000	-0.222226
4	-250.000000	-0.220218
5	-248.000000	-0.217500
6	-246.000000	-0.213590
7	-244.000000	-0.208701
8	-242.000000	-0.202295
9	-240.000000	-0.194550
10	-238.000000	-0.184896
11	-236.000000	-0.173501
12	-234.000000	-0.159793

Card Data Customization Parameter Dialog:



The image shows a Windows-style dialog box titled "Time Filter" with a close button (X) in the top right corner. The main title inside the dialog is "Customize Time Filter File Format".

The dialog contains several input fields:

- No. of comment records preceeding data:** A text box containing the value "1".
- File header field:** A section with two sub-headers: "Start column" and "Length".
 - Number of rows:** A text box containing "1" under "Start column" and a text box containing "9" under "Length".
- Data header field:** A section with two sub-headers: "Start column" and "Length".
 - Time:** A text box containing "1" under "Start column" and a text box containing "9" under "Length".
 - Amplitude:** A text box containing "11" under "Start column" and a text box containing "9" under "Length".
- Enter the length of each record in the file in bytes:** A text box containing the value "80".

At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the time domain filter coefficients in the time filter file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the time series values (in milliseconds) associated with a given filter coefficient in the output time filter file.

Amplitude — Enter the start column and the number of columns allocated to write the amplitude value associated with a given time series coefficient in the output time filter file.

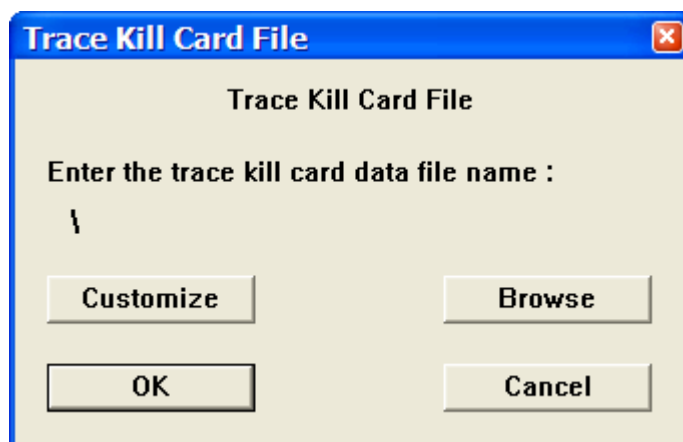
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the time filter file.

Trace Kills

Usage:

The Trace Kills card data item is used to store the trace header values of traces that have been killed by the Automatic Trace Edits step or that will be killed with the Kill Traces step. In the case of traces that were killed by the Automatic Trace Edits step, the Trace Kills card file will contain the calculated value of trace semblance in the User Defined 1 field and the calculated value of the power ratio decay in the User Defined 2 field.

Step Parameter Dialog:



Trace Kill Card File

Enter the trace kill card data file name :

\

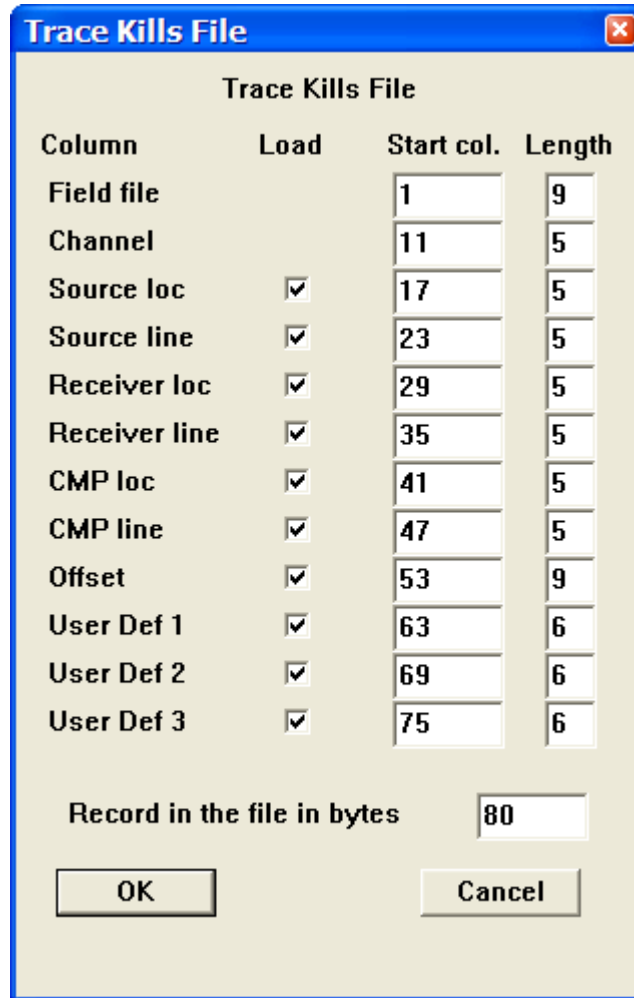
Customize Browse

OK Cancel

Example Card Data:

Killed Traces												
		Add Row		Del Row		Cell Math						
	FFID	Channel	Shot Location	Shot Line	Rx Location	Rx Line	CMP Location	CMP Line	Offset	User Def 1	User Def 2	User Def 3
1	389	1	388.000000	1225	339.000000	1225	363.500000	1225	-1715.000000	0.848300	0.000000	0.000000
2	391	2	388.000000	1225	332.000000	1225	356.000000	1225	-1680.000000	0.853600	0.000000	0.000000
3	391	4	388.000000	1225	334.000000	1225	357.000000	1225	-1610.000000	0.855500	0.000000	0.000000
4	392	4	376.000000	1225	330.000000	1225	353.000000	1225	-1610.000000	0.855100	0.000000	0.000000
5	393	1	372.000000	1225	323.000000	1225	347.500000	1225	-1715.000000	0.852800	0.000000	0.000000
6	405	96	324.000000	1225	373.000000	1225	348.500000	1225	1715.000000	0.847400	0.000000	0.000000
7	415	3	292.000000	1225	245.000000	1225	268.500000	1225	-1645.000000	0.859600	0.000000	0.000000
8	418	93	280.000000	1225	326.000000	1225	303.000000	1225	1610.000000	0.839900	0.000000	0.000000
9	419	8	276.000000	1225	234.000000	1225	255.000000	1225	-1470.000000	0.852200	0.000000	0.000000
10	461	92	112.000000	1225	157.000000	1225	134.500000	1225	1575.000000	0.859700	0.000000	0.000000

Card Data Customization Parameter Dialog:



The dialog box is titled "Trace Kills File" and contains a table with four columns: "Column", "Load", "Start col.", and "Length". The table lists various data fields and their corresponding start column and length. The "Load" column contains checkboxes, all of which are checked. Below the table, there is a field labeled "Record in the file in bytes" with the value "80". At the bottom, there are "OK" and "Cancel" buttons.

Column	Load	Start col.	Length
Field file		1	9
Channel		11	5
Source loc	<input checked="" type="checkbox"/>	17	5
Source line	<input checked="" type="checkbox"/>	23	5
Receiver loc	<input checked="" type="checkbox"/>	29	5
Receiver line	<input checked="" type="checkbox"/>	35	5
CMP loc	<input checked="" type="checkbox"/>	41	5
CMP line	<input checked="" type="checkbox"/>	47	5
Offset	<input checked="" type="checkbox"/>	53	9
User Def 1	<input checked="" type="checkbox"/>	63	6
User Def 2	<input checked="" type="checkbox"/>	69	6
User Def 3	<input checked="" type="checkbox"/>	75	6

Record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Field File — Enter the start column and the number of columns allocated to write the field file number associated with the trace kill.

Channel — Enter the start column and the number of columns allocated to write the channel number associated with the trace kill.

Source loc — Enter the start column and the number of columns allocated to write the source location associated with the trace kill.

Source line — Enter the start column and the number of columns allocated to write the source line associated with the trace kill.

Receiver loc — Enter the start column and the number of columns allocated to write the receiver location associated with the trace kill.

Receiver line — Enter the start column and the number of columns allocated to write the receiver line associated with the trace kill.

CMP loc — Enter the start column and the number of columns allocated to write the CMP location associated with the trace kill.

CMP line — Enter the start column and the number of columns allocated to write the CMP line associated with the trace kill.

Offset — Enter the start column and the number of columns allocated to write the source-receiver offset associated with the trace kill.

User Def 1 — Enter the start column and the number of columns allocated to write the value stored in the User Def 1 trace header field of the trace kill. In the case of a trace kill output by the Automatic Trace Edits step, this value will correspond to the calculated trace semblance.

User Def 2 — Enter the start column and the number of columns allocated to write the value stored in the User Def 2 trace header field of the trace kill. In the case of a trace kill output by the Automatic Trace Edits step, this value will correspond to the calculated power ratio decay.

User Def 3 — Enter the start column and the number of columns allocated to write the value stored in the User Def 3 trace header field of the trace kill. This value is currently undefined, and may contain optional information defined by the user.

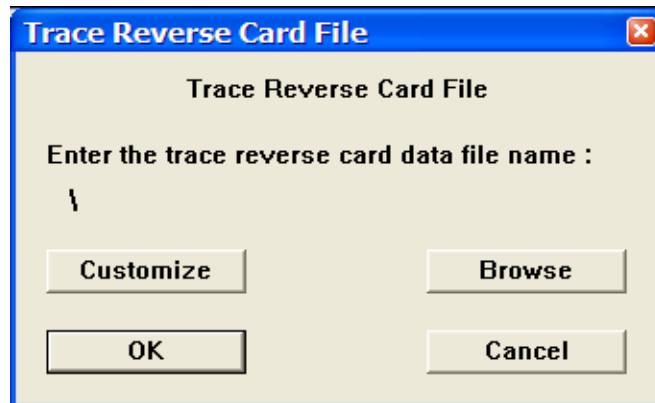
Record in the file in bytes – Enter the length in bytes of one line of the trace kills file.

Trace Reversals

Usage:

The Trace Reversals card data item is used to store the trace header values of traces whose polarity will be reversed with the Reverse Traces step..

Step Parameter Dialog:



Trace Reverse Card File

Enter the trace reverse card data file name :

\

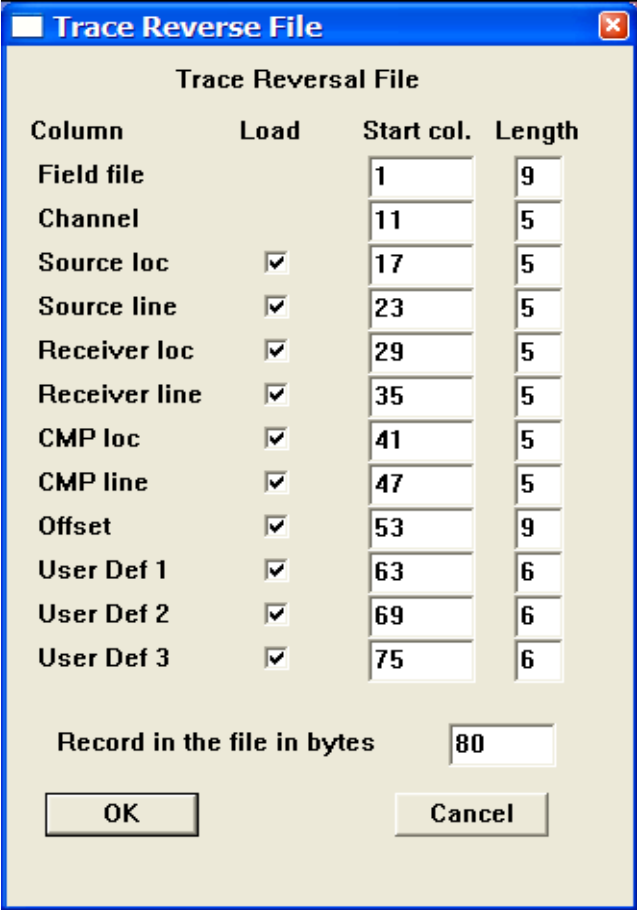
Customize Browse

OK Cancel

Example Card Data:

Trace Polarity Reversals												
		Add Row		Del Row		Cell Math						
	FFID	Channel	Shot Location	Shot Line	Rx Location	Rx Line	CMP Location	CMP Line	Offset	User Def 1	User Def 2	User Def 3
1	1	11	104.000000	101	112.000000	101	108.000000	101	525.000000			
2	3	11	110.000000	101	112.000000	101	111.000000	101	525.000000			
3	6	11	119.000000	101	112.000000	101	115.500000	101	525.000000			
4	12	11	137.000000	101	112.000000	101	124.500000	101	525.000000			
5	21	11	164.000000	101	112.000000	101	138.000000	101	525.000000			
6	22	14	167.000000	101	115.000000	101	141.000000	101	600.000000			
7	45	14	236.000000	101	115.000000	101	175.500000	101	600.000000			
8	87	14	362.000000	101	115.000000	101	238.500000	101	600.000000			

Card Data Customization Parameter Dialog:



The dialog box is titled "Trace Reverse File" and contains a table for configuring the Trace Reversal File. The table has four columns: Column, Load, Start col., and Length. The rows include Field file, Channel, Source loc, Source line, Receiver loc, Receiver line, CMP loc, CMP line, Offset, User Def 1, User Def 2, and User Def 3. Each row has a checkbox in the Load column and input fields for Start col. and Length. Below the table is a field for "Record in the file in bytes" set to 80. At the bottom are OK and Cancel buttons.

Column	Load	Start col.	Length
Field file		1	9
Channel		11	5
Source loc	<input checked="" type="checkbox"/>	17	5
Source line	<input checked="" type="checkbox"/>	23	5
Receiver loc	<input checked="" type="checkbox"/>	29	5
Receiver line	<input checked="" type="checkbox"/>	35	5
CMP loc	<input checked="" type="checkbox"/>	41	5
CMP line	<input checked="" type="checkbox"/>	47	5
Offset	<input checked="" type="checkbox"/>	53	9
User Def 1	<input checked="" type="checkbox"/>	63	6
User Def 2	<input checked="" type="checkbox"/>	69	6
User Def 3	<input checked="" type="checkbox"/>	75	6

Record in the file in bytes: 80

OK Cancel

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Field File — Enter the start column and the number of columns allocated to write the field file number associated with the trace kill.

Channel — Enter the start column and the number of columns allocated to write the channel number associated with the trace kill.

Source loc — Enter the start column and the number of columns allocated to write the source location associated with the trace kill.

Source line — Enter the start column and the number of columns allocated to write the source line associated with the trace kill.

Receiver loc — Enter the start column and the number of columns allocated to write the receiver location associated with the trace kill.

Receiver line — Enter the start column and the number of columns allocated to write the receiver line associated with the trace kill.

CMP loc — Enter the start column and the number of columns allocated to write the CMP location associated with the trace kill.

CMP line — Enter the start column and the number of columns allocated to write the CMP line associated with the trace kill.

Offset — Enter the start column and the number of columns allocated to write the source-receiver offset associated with the trace kill.

User Def 1 — Enter the start column and the number of columns allocated to write the value stored in the User Def 1 trace header field of the trace kill. In the case of a trace kill output by the Automatic Trace Edits step, this value will correspond to the calculated trace semblance.

User Def 2 — Enter the start column and the number of columns allocated to write the value stored in the User Def 2 trace header field of the trace kill. In the case of a trace kill output by the Automatic Trace Edits step, this value will correspond to the calculated power ratio decay.

User Def 3 — Enter the start column and the number of columns allocated to write the value stored in the User Def 3 trace header field of the trace kill. This value is currently undefined, and may contain optional information defined by the user.

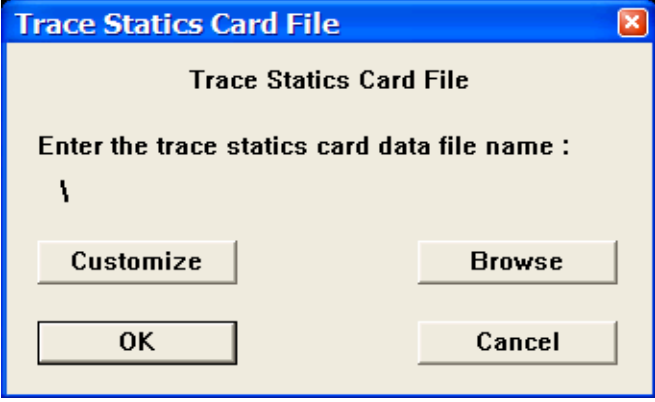
Record in the file in bytes – Enter the length in bytes of one line of the trace kills file

Trace Statics

Usage:

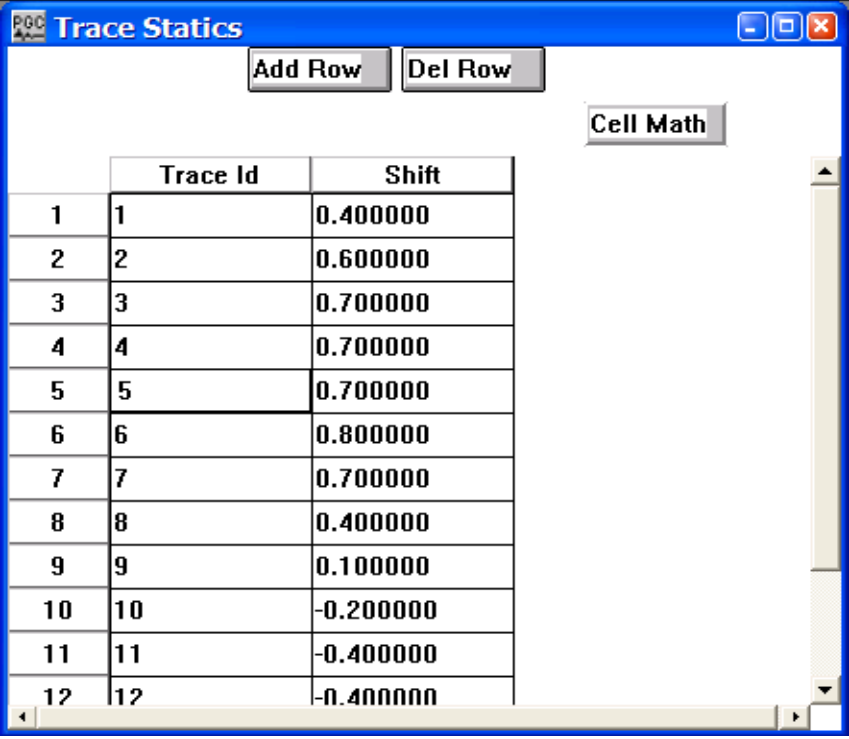
The Trace Statics card data item is used to store trace static values in units of milliseconds as a function of trace ID.

Step Parameter Dialog:



The dialog box is titled "Trace Statics Card File". It contains a text input field with the label "Enter the trace statics card data file name :". Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



The window is titled "Trace Statics". It features a table with two columns: "Trace Id" and "Shift". Above the table are buttons for "Add Row", "Del Row", and "Cell Math". The table contains 12 rows of data.

	Trace Id	Shift
1	1	0.400000
2	2	0.600000
3	3	0.700000
4	4	0.700000
5	5	0.700000
6	6	0.800000
7	7	0.700000
8	8	0.400000
9	9	0.100000
10	10	-0.200000
11	11	-0.400000
12	12	-0.400000

Card Data Customization Parameter Dialog:

Customize Trace Statics

Customize Trace Statics File Format

No. of comment records preceeding data

File header field	Start column	Length
Number of rows	<input type="text" value="1"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Trace ID	<input type="text" value="1"/>	<input type="text" value="9"/>
Time	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of rows — Enter the start column and the number of columns allocated to write the number of static values in the trace statics file.

Data header field:

Trace ID — Enter the start column and the number of columns allocated to write the trace ID number in the trace statics file.

Time — Enter the start column and the number of columns allocated to write the trace static (in milliseconds) in the trace static file.

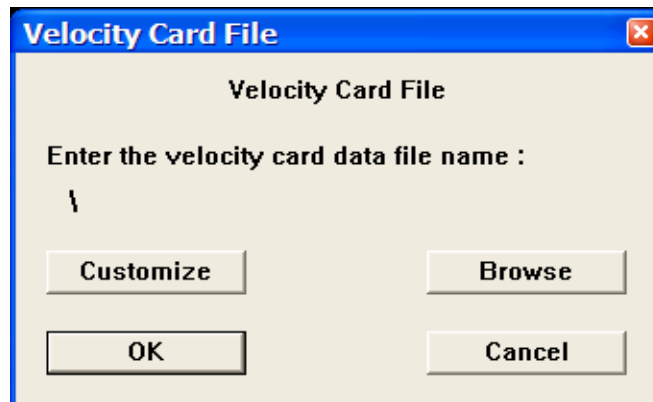
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the trace statics file.

Velocity Function

Usage:

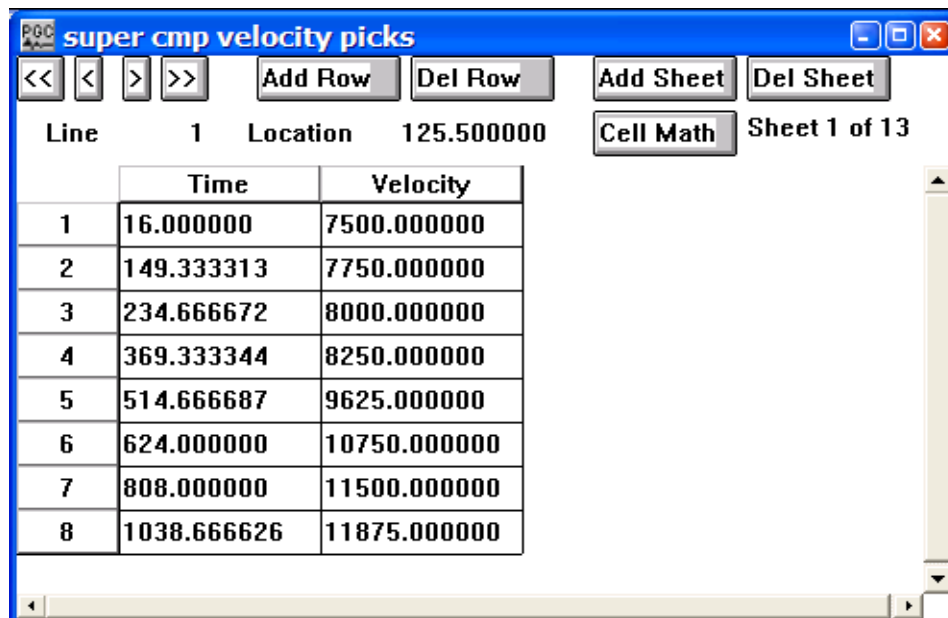
The Velocity Function card data item is used to store time-velocity pairs. Stacking velocities may be picked interactively in SeisViewer using the Pick Traces tool located in the Picking menu..

Step Parameter Dialog:



A dialog box titled "Velocity Card File" with a blue border and a close button (X) in the top right corner. The main area is light beige. It contains the text "Velocity Card File" centered at the top. Below it, the text "Enter the velocity card data file name :" is followed by a text input field containing a backslash character (\). At the bottom, there are four buttons: "Customize", "Browse", "OK", and "Cancel".

Example Card Data:



A screenshot of a software window titled "super cmp velocity picks". The window has a blue title bar and standard Windows window controls (minimize, maximize, close). Below the title bar is a toolbar with buttons: "<<", "<", ">", ">>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The main area displays a table with 3 columns: "Line", "Time", and "Velocity". The table has 8 rows of data. The "Line" column has values 1 through 8. The "Time" column has values ranging from 16.000000 to 1038.666626. The "Velocity" column has values ranging from 7500.000000 to 11875.000000. The status bar at the bottom right indicates "Sheet 1 of 13".

Line	Time	Velocity
1	16.000000	7500.000000
2	149.333313	7750.000000
3	234.666672	8000.000000
4	369.333344	8250.000000
5	514.666687	9625.000000
6	624.000000	10750.000000
7	808.000000	11500.000000
8	1038.666626	11875.000000

Card Data Customization Parameter Dialog:

Customize Velocity

Customize Velocity File Format

Number of comment records preceeding data

File header field	Start column	Length
No. of velocity locations (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Time	<input type="text" value="1"/>	<input type="text" value="9"/>
Velocity	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of velocity locations — Enter the start column and the number of columns allocated to write the number of velocity locations in the velocity file.

Sheet header field:

CMP line number — Enter the start column and the number of columns allocated to write the CMP line number associated with a velocity function in the velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a velocity function in the velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the CMP locations per CMP line in the velocity file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the two-way travel time (in milliseconds) associated with a given velocity pick in the velocity file.


Velocity — Enter the start column and the number of columns allocated to write the RMS or interval velocity value associated with a given velocity pick in the velocity file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the velocity function file.

Display Steps

This section documents the processing steps available in the Display Steps category.

Processing steps currently available are:

	Processing Categories
Real Time Near Trace Display	
Real Time Receiver Attribute Map	
Real Time Seismic Display	
Real Time Source Attribute Map	
Real Time Stack Display	

Real Time Seismic Display

Usage:

The Real Time Seismic Display process is used to display seismic records during the processing flow. It also can output image files and automatically ftp these image files to a server on an active internet connection.

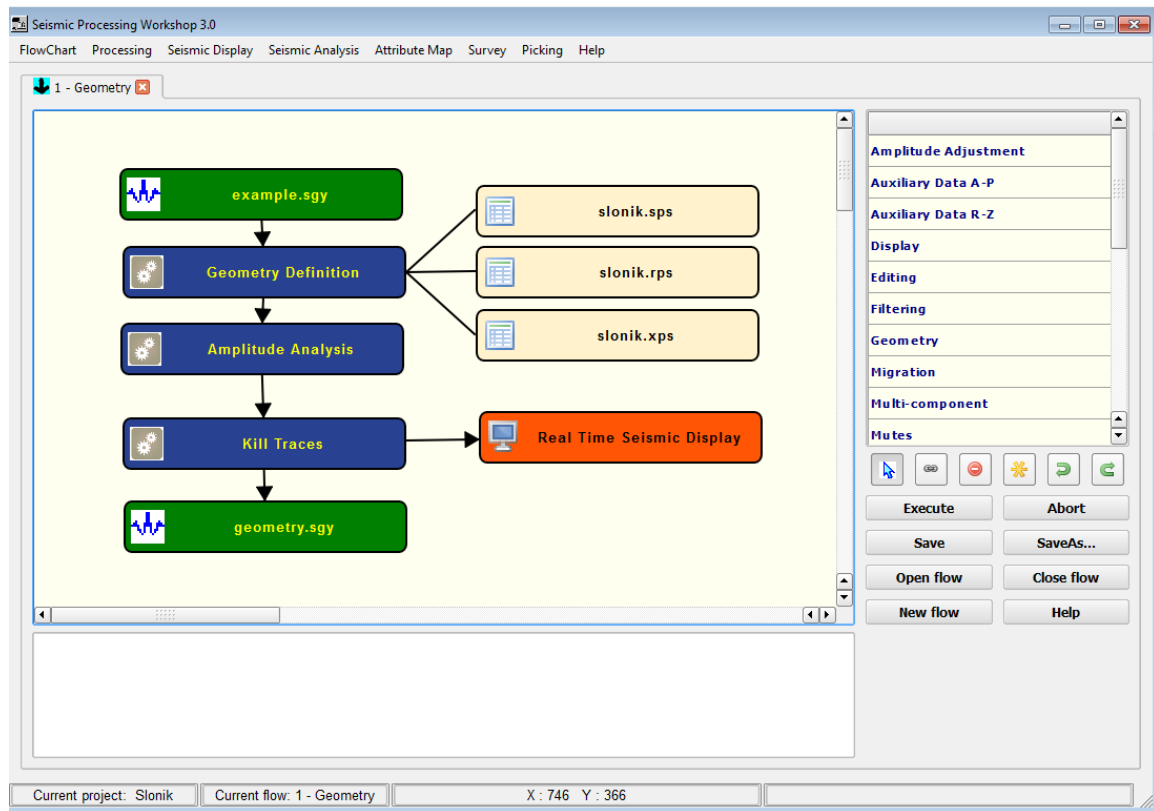
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

none

Example Flowchart:



Step Parameter Dialog:

The dialog box is titled "Real Time Seismic Display" and contains several sections for configuring seismic data display.

- Display increment:** Includes a text field for "Record increment between displays" set to 10, and three checkboxes: "Also display all records killed during processing" (checked), "Only display records killed during processing" (unchecked), and "Mark dead traces" (checked).
- Image output:** Includes checkboxes for "Output image files" (checked) and "Send via ftp" (unchecked). It also has dropdowns for "Image format" (JPG), "Image increment" (1), "Image quality" (Medium), and "Output colorbar" (No).
- Display parameters:** Includes dropdowns for "Trace display type" (Variable area wiggle), "Trace polarity" (Normal), and "Orientation" (Right-to-left). It also has spinners for "Horizontal scale" (24.0), "Vertical scale" (4.0), "Display gain" (0.0), and "Trace excursion" (2.0). Additionally, it has dropdowns for "Horizontal units" (Traces/in), "Vertical units" (In/sec), "Amplitude type" (Gain contr), and a spinner for "Window (ms)" (1000.00).
- Display title:** A text field for entering a title.
- Display color scale:** A "Select" button, a text field, and a color wheel icon.

At the bottom are "OK", "Help", and "Cancel" buttons.

Parameter descriptions:

Record increment between displays – The interval between records to be displayed.

Real Time Source Attribute Map

Usage:

The Real Time Source Attribute Map process is used to display maps of source attributes (amplitudes, frequency attributes) during the processing flow.

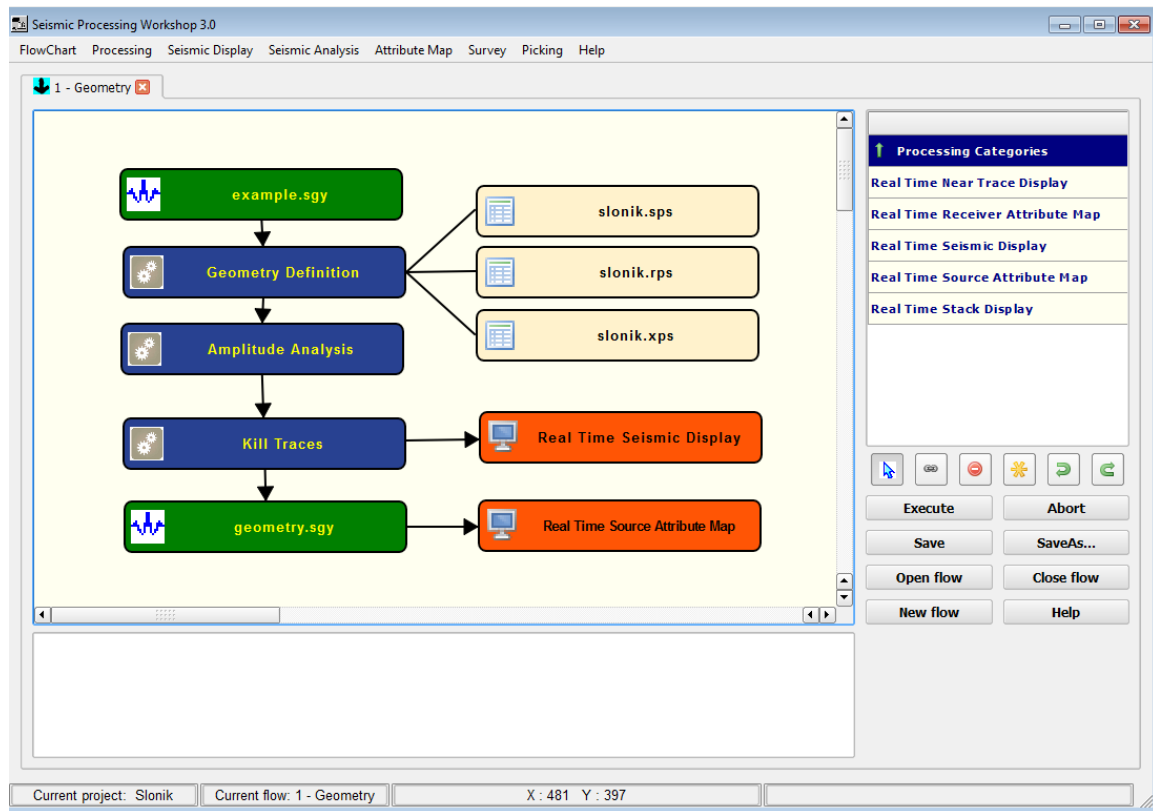
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

none

Example Flowchart:



Step Parameter Dialog:

Real Time Attribute Map

Trace header containing attribute
Trace header: User Defined 1

Coordinate reference system
☐ Acquisition ☒ Geographic

Multichannel attribute composition
☒ RMS Amplitude ☐ Average magnitude
☐ Median magnitude ☐ Maximum magnitude

Map scale
☒ Scale to fit view Height (pixels): 960
☐ Scale to fit dimensions: Width (pixels): 1200
☐ Scale to fit vertical
☐ Scale to fit horizontal Fixed scale: 10

Map title
[Text Field]

Attribute label
[Text Field]

Attribute color scale
Select [Color Picker]

Reference locations
☐ Initialize source locations from SPS file(s)
Add File Remove File
File name
Horizontal axis minimum Horizontal axis maximum
Vertical axis minimum Vertical axis maximum

Background image
☐ Display background image on receiver spread
Load Image Configure Unload image
☐ Loaded ☐ Configured

Map output
Output file name: C:/Slonik/Survey/ File Browse...

OK Help Cancel

Parameter descriptions:

Trace header – The trace header field containing the attribute to be mapped.

Editing Steps

This section documents the processing steps available in the Editing Steps category.

Processing steps currently available are:

Processing Categories	
↑	Automatic Trace Edit
	Dataset Math
	Kill Traces
	Phase Rotation
	Remove DC Bias
	Remove Reverberation
	Reverse Traces
	S/N Based Record Edits
	Trace Header Calculation
	Trace Header Logic
	Trace Header Math
	Trace Header Resequencing
	Trace Sample Math

Automatic Trace Edit

Usage:

The Automatic Trace Edit step allows you to automatically remove invalid or noisy traces from your data set based on user defined criteria. An option exists to output both the trace header values corresponding to the edited traces to a Trace Kills card data file.

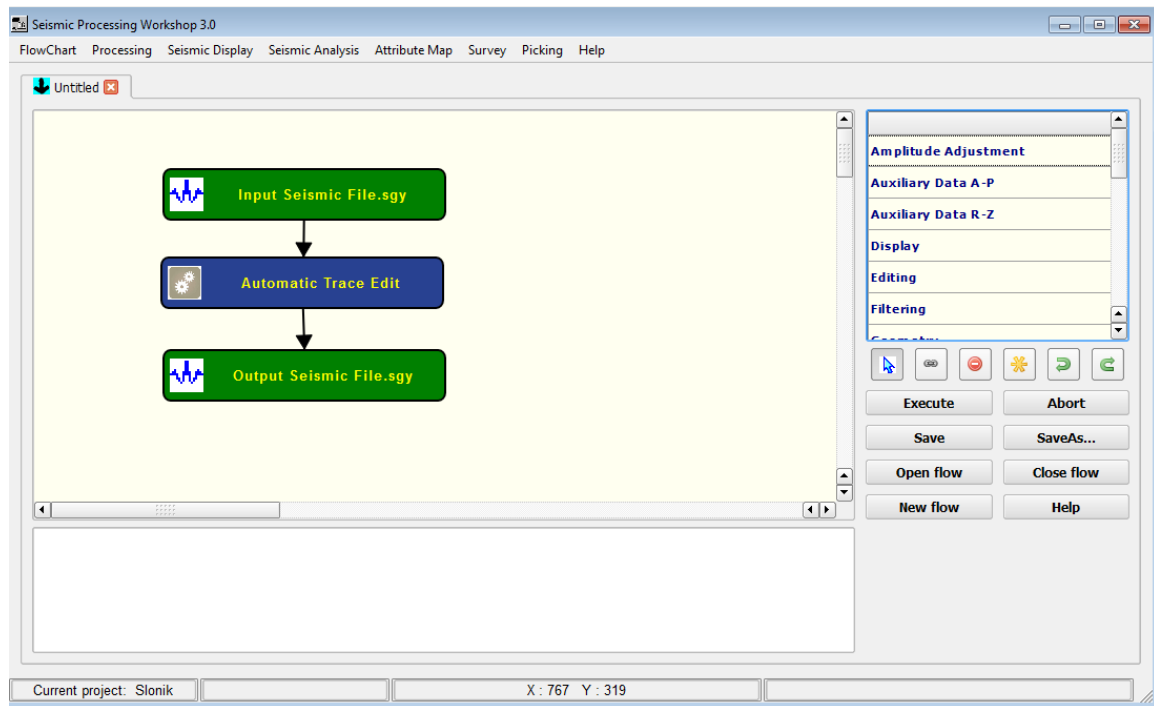
Input Links:

- 1) Seismic data in any sort order (mandatory).

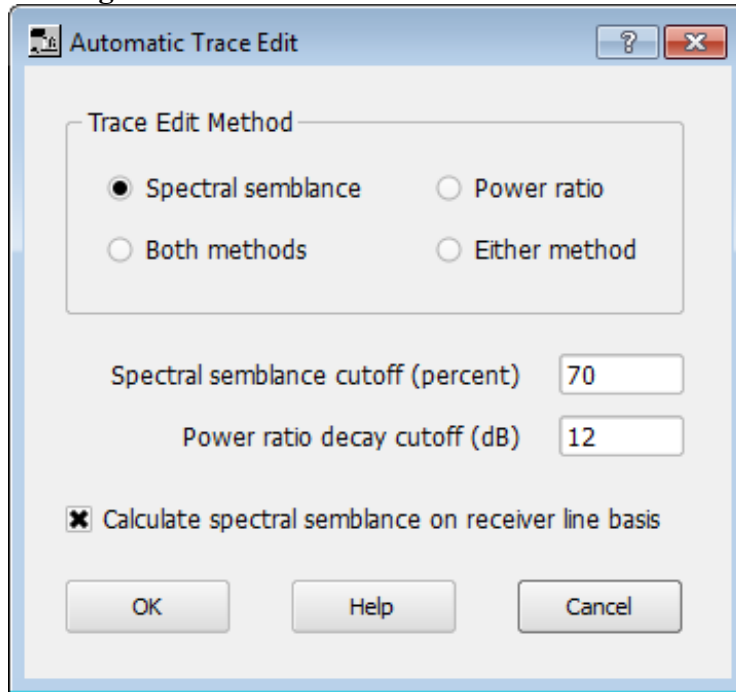
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace Edit Method: — Select the analysis method(s) to be used to determine if a trace will be killed.

Spectral semblance — The spectral semblance method uses the semblance between a single traces power spectrum and the average power spectrum of the gather as the basis for killing a trace.

Power ratio — The power ratio method uses the ratio of trace energy in the upper part of a trace to that in the lower part of a trace as the basis for killing a trace. This is often an effective means of editing traces that are contaminated with 60 Hz powerline noise, which does not decay as a function of record time.

Both methods — Traces will be killed only if they fail BOTH the power ratio test AND the spectral semblance test.

Either method — Traces will be killed if they fail EITHER the power ratio test OR the spectral semblance test.

Spectral semblance cutoff percent — If you choose the spectral semblance method, enter the minimum semblance value you expect for each trace's power spectrum relative to the power spectrum for the gather.

Power ratio decay cutoff in dB — If you choose the power ratio method, enter the minimum decay of trace energy in dB that you expect between the first and second half of the trace.

Dataset Math

Usage:

The Dataset Math step will add, subtract, multiply, divide or do adaptive subtraction between the samples of one data file from the corresponding samples of a second data file and output the result to a seismic file.

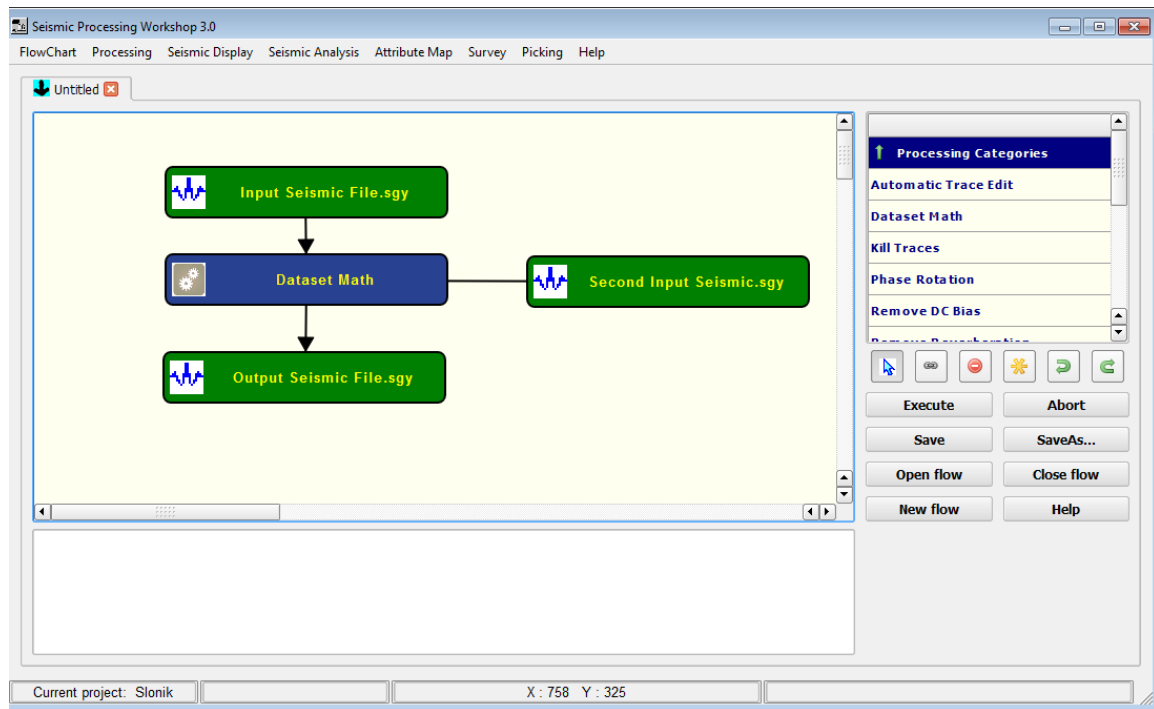
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order (mandatory) – must match the first dataset.

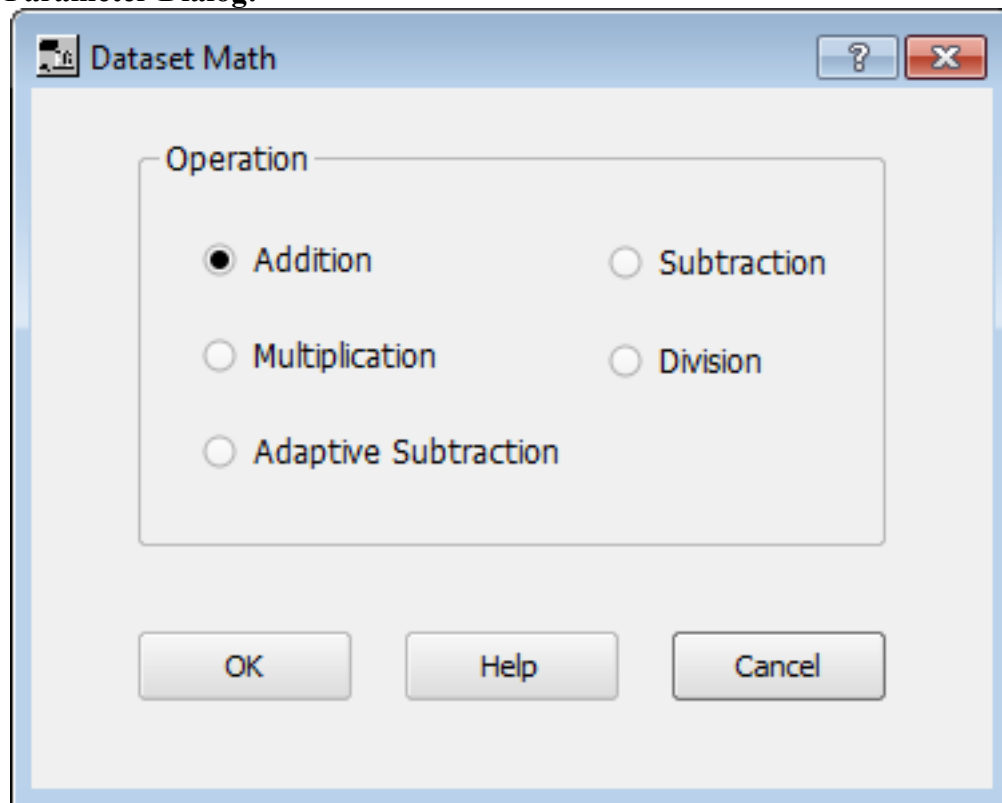
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Operation – Select the math operation to perform between the samples of the two datasets.

Kill Traces

Usage:

The Kill Traces step kills traces according to specified trace header values and ranges.

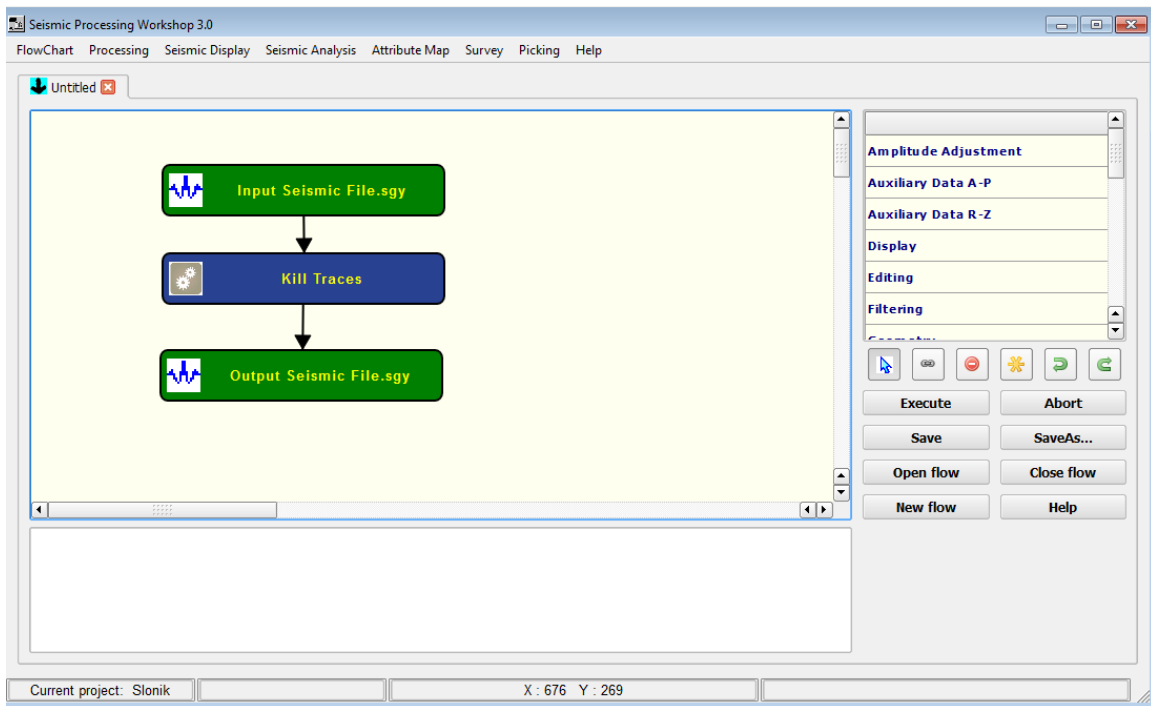
Input Links:

- 1) Seismic data in any sort order (mandatory).

Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Primary header	Primary start	Primary stop	Secondary header	Secondary start	Secondary stop	Tertiary header	Tertiary start	Tertiary stop
Field File	150	152	Channel	1	3	None	0	0
None	173	173	Receiver Location	101	101	None	0	0

Buttons: Import, Export, Add Row, Delete Row, ☒ Set dead trace amplitudes to zero, OK, Help, Cancel

Parameter Description:

Primary header — Select the first trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Primary start — Enter the start value for the first selected header field.

Primary stop — Enter the end value for the first selected header field.

Secondary header — Select the second trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Secondary start — Enter the start value for the second selected header field.

Secondary stop — Enter the end value for the second selected header field.

Tertiary header — Select the third trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Tertiary start — Enter the start value for the third selected header field.

Tertiary stop — Enter the end value for the third selected header field.

Import — Import a set of picked trace kills from a Trace Kills auxiliary dataset.

Export — Export the entered trace kills into a Trace Kills auxiliary dataset.

Add Row — Add a row to dialog.

Delete Row — Delete a row from the dialog.

Set dead trace amplitude to zero — Fill dead traces with zeros.

Phase Rotation

Usage:

The Phase Rotation step allows you to rotate your seismic traces by a constant phase angle from -180 to $+180$ degrees. Values outside this range will be wrapped back into this range (i.e. 240 degrees is equivalent to -60 degrees).

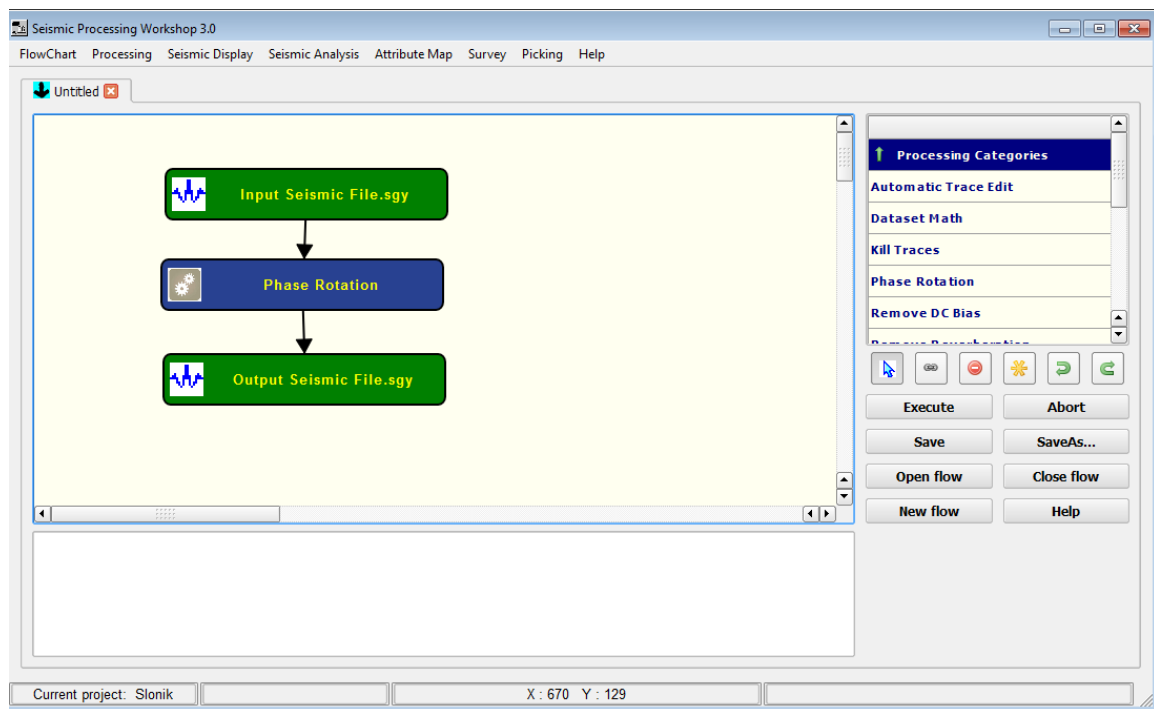
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Phase Rotation

☐ Rotate based on header value

If Component trace header Receiver Comp

== 2.00

☐ Rotate by angle stored in trace header value

Rotation angle in trace header None

Phase rotation angle (degrees) -90.0

OK Help Cancel

Parameter Description:

Rotate based on header value — If the phase rotation is only to be applied to some traces in the dataset, then a trace header value may be used to control which traces are rotated. An example of where this is useful is transition zone seismic where some receivers in a line are geophones and some are hydrophones. Rotating the hydrophone by -90 matches the data from the geophone.

If Component trace header – Select the trace header to be used for controlling the operation.

== - Select the logic operator (<, <=, ==, >, >= or !=) to be used in determining the traces to used in the operation.

Rotate by angle stored in trace header value – Alternative to doing a constant phase rotation, a header value (degrees) may be used.

Rotation angle in trace header – Select the trace header word containing the rotation angle (degrees).

Phase rotation angle (degrees) — Enter the constant phase rotation angle to apply to all the seismic data traces unless Rotate by angle stored in trace header value is checked.

Remove DC Bias

Usage:

The Remove DC Bias step removes the average or median DC bias on a trace by trace basis.

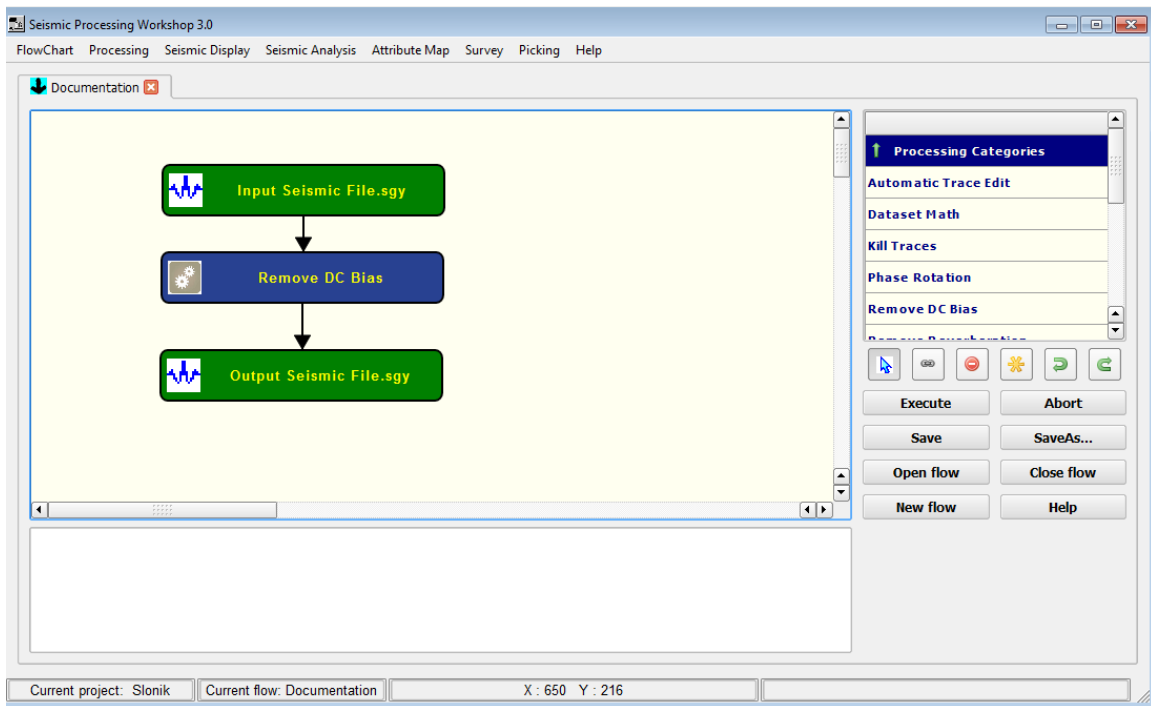
Input Links:

1) Seismic data in any sort order (mandatory).

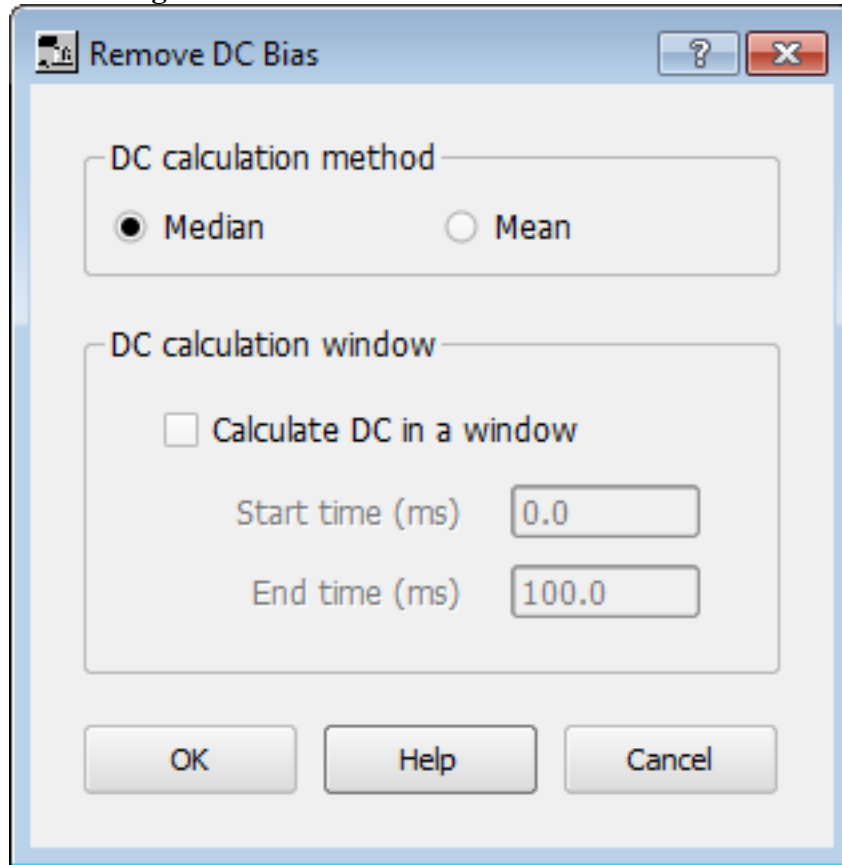
Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Average Value — Select the method for calculating the DC bias to be removed. You may use either a median or a mean.

Calculate DC in a window — If checked, only the entered window of each trace will be used to calculate the DC.

Minimum time (ms) — Enter the start time of the window to be used for calculating the DC value.

Maximum time (ms) — Enter the ending time of the window to be used for calculating the DC value.

Remove Reverberation

Usage:

The Remove Reverberation step searches for reverberations in the signal and attempts to remove these using an adaptive filtering technique.

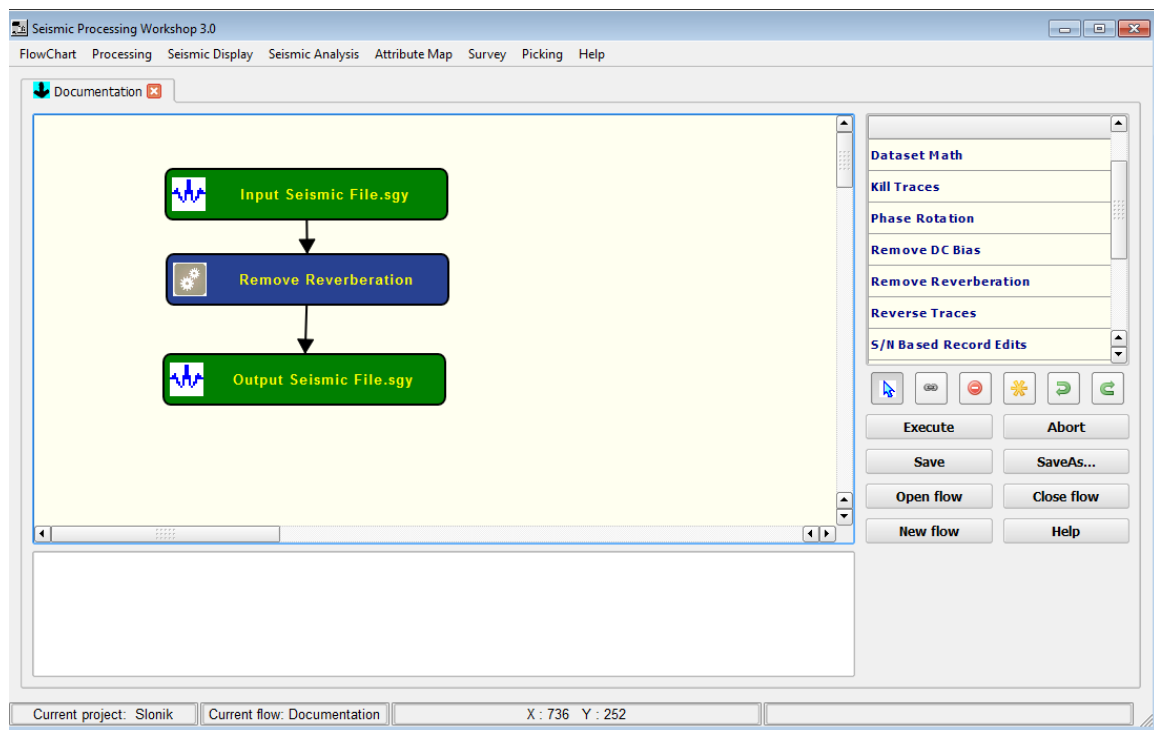
Input Links:

- 1) Seismic data in any sort order (mandatory).

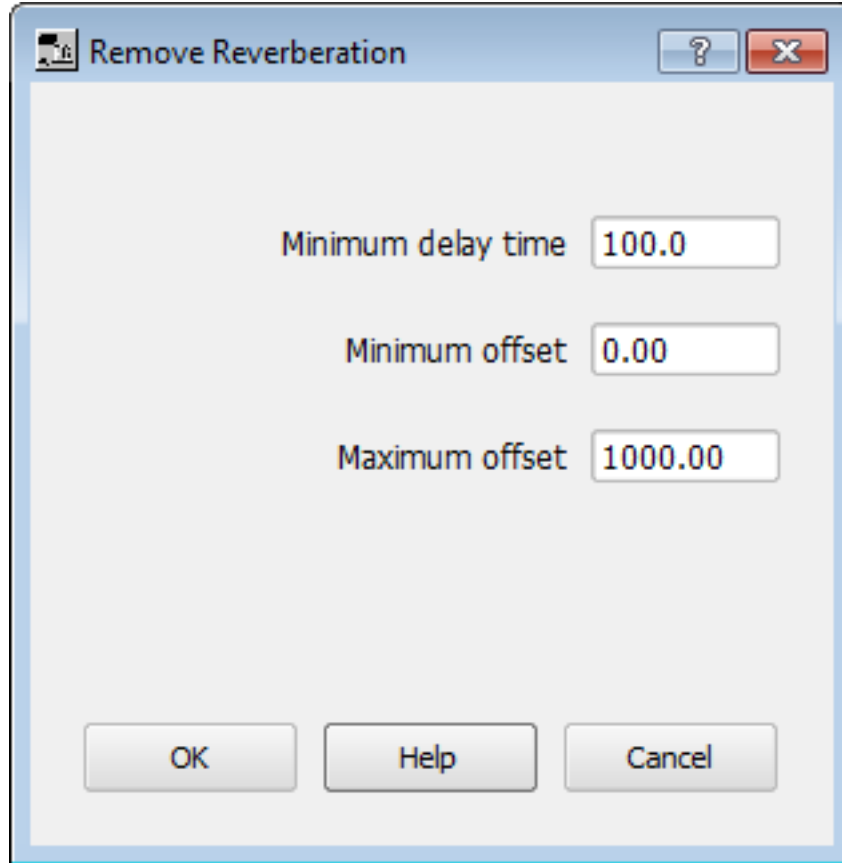
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Remove Reverberation". It has a standard title bar with a question mark icon and a close button (X). The dialog contains three input fields with labels to their left: "Minimum delay time" with a value of "100.0", "Minimum offset" with a value of "0.00", and "Maximum offset" with a value of "1000.00". At the bottom of the dialog are three buttons: "OK", "Help", and "Cancel".

Parameter Description:

Minimum delay time — Enter the minimum delay time to use in searching for the reverberation.

Minimum offset — Enter the minimum offset to use in searching for the reverberation.

Maximum offset — Enter the maximum offset to use in searching for the reverberation.

Reverse Traces

Usage:

The Reverse Traces step allows you to invert the polarity of traces according specified trace header values and ranges.

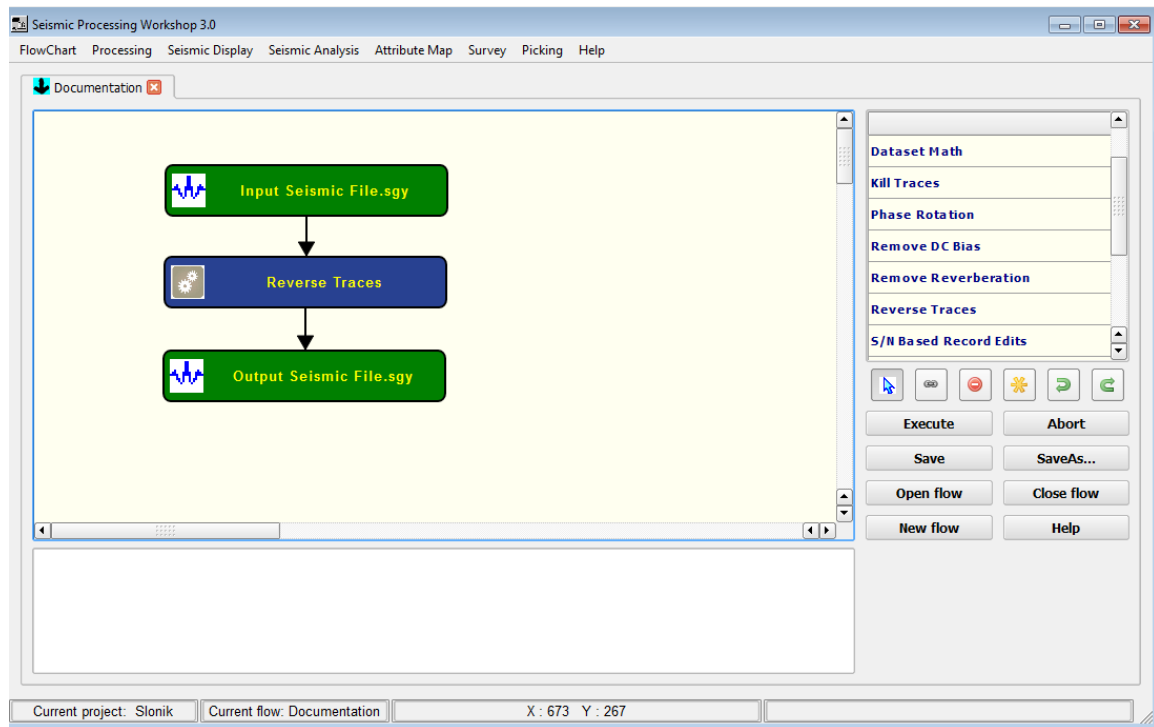
Input Links:

- 1) Seismic data in any sort order (mandatory).

Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Primary header	Primary start	Primary stop	Secondary header	Secondary start	Secondary stop	Tertiary header	Tertiary start	Tertiary stop
Field File ▼	123	134	Channel ▼	1	2	None ▼	0	0
Source Location ▼	501	510	Receiver Location ▼	432	432	None ▼	0	0

Buttons: Import, Export, Add Row, Delete Row, OK, Help, Cancel

Parameter Description:

Primary header — Select the first trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Primary start — Enter the start value for the first selected header field.

Primary stop — Enter the end value for the first selected header field.

Secondary header — Select the second trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Secondary start — Enter the start value for the second selected header field.

Secondary stop — Enter the end value for the second selected header field.

Tertiary header — Select the third trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Tertiary start — Enter the start value for the third selected header field.

Tertiary stop — Enter the end value for the third selected header field.

Import — Import a set of picked trace reversals from a Trace Reversals auxiliary dataset.

Export — Export the entered trace reversals into a Trace Reversals auxiliary dataset.

Add Row — Add a row to dialog.

Delete Row — Delete a row from the dialog.

Trace Header Cell Math

Usage:

The Trace Header Cell Math step allows you modify the trace header values of a seismic trace using standard mathematical operations.

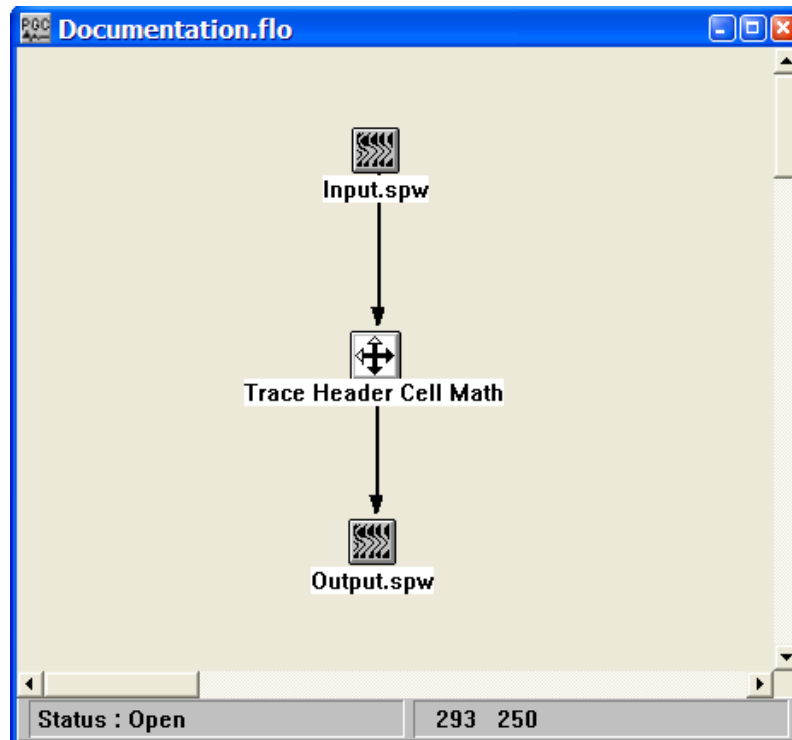
Input Links:

1) Seismic data in any sort order (mandatory).

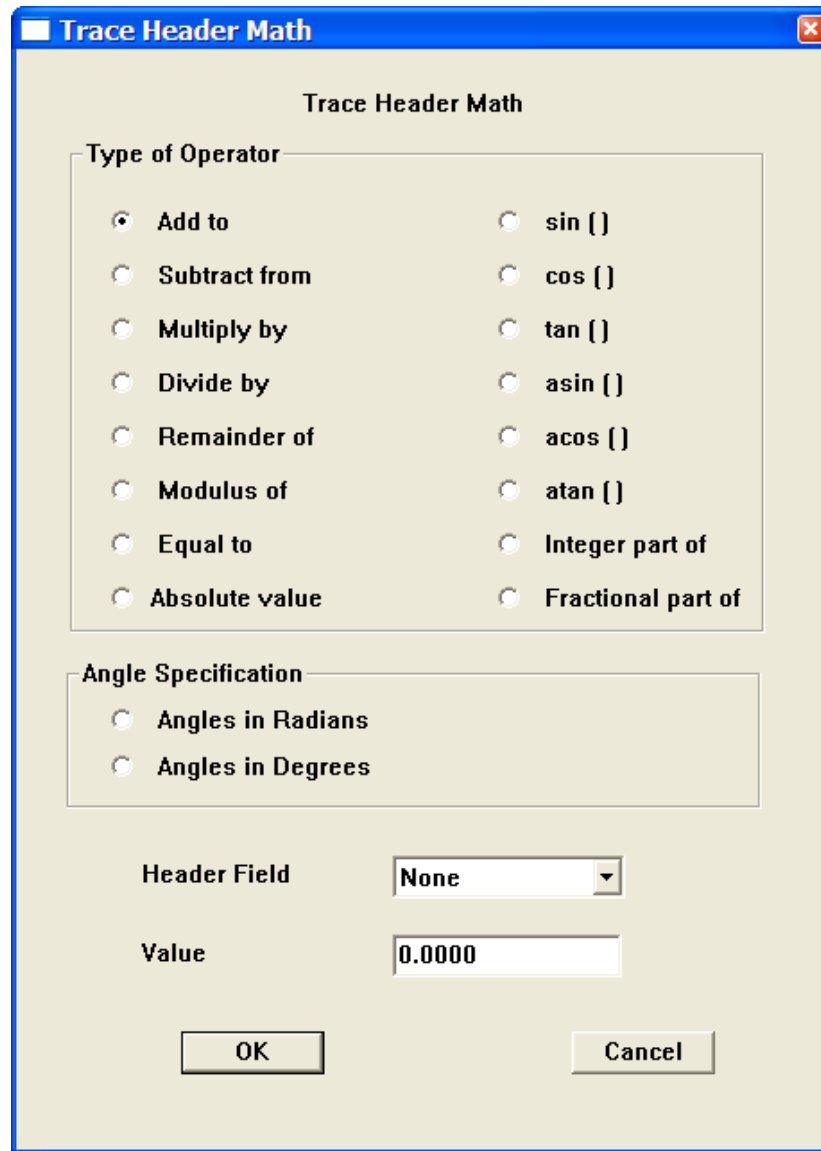
Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Trace Header Math". It has a blue title bar with a close button in the top right corner. The main area is light beige and contains two grouped sections of radio buttons. The first section, "Type of Operator", lists 14 mathematical operations in two columns. The second section, "Angle Specification", has two radio buttons. Below these are two input fields: "Header Field" with a dropdown menu showing "None", and "Value" with a text box containing "0.0000". At the bottom are "OK" and "Cancel" buttons.

Trace Header Math

Type of Operator

- ☒ Add to
- ☐ Subtract from
- ☐ Multiply by
- ☐ Divide by
- ☐ Remainder of
- ☐ Modulus of
- ☐ Equal to
- ☐ Absolute value
- ☐ sin ()
- ☐ cos ()
- ☐ tan ()
- ☐ asin ()
- ☐ acos ()
- ☐ atan ()
- ☐ Integer part of
- ☐ Fractional part of

Angle Specification

- ☐ Angles in Radians
- ☐ Angles in Degrees

Header Field: None

Value: 0.0000

OK Cancel

Parameter Description:

Type of operator — Select the mathematical operation that will be applied to the seismic trace header.

Angle Specification — If a trigonometric operation is to be performed, indicate whether the angles involved are measured in units of degrees or radians.

Header Field — Select the trace header field to be modified.

Value — Enter the value that will be used to modify the selected trace header field.

Example: Add 40 to the existing value of the Uphole time.

Trace Header Math

Trace Header Math

Type of Operator

- ☒ Add to
- ☐ Subtract from
- ☐ Multiply by
- ☐ Divide by
- ☐ Remainder of
- ☐ Modulus of
- ☐ Equal to
- ☐ Absolute value
- ☐ sin ()
- ☐ cos ()
- ☐ tan ()
- ☐ asin ()
- ☐ acos ()
- ☐ atan ()
- ☐ Integer part of
- ☐ Fractional part of

Angle Specification

- ☐ Angles in Radians
- ☐ Angles in Degrees

Header Field Uphole Time ▼

Value 40

OK Cancel

Trace Header Column Math

Usage:

The Trace Header Column Math step allows you modify the trace header values of a seismic trace using standard mathematical operations on combinations of trace header values.

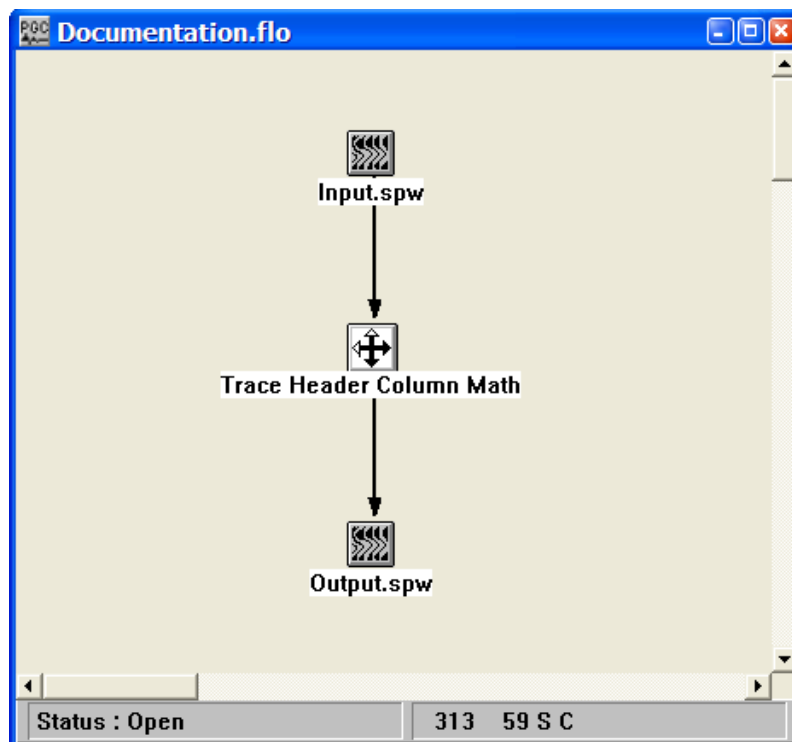
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Trace Header Column Math

Trace Header Column Math

Type of Operator

- ☒ A + B
- ☐ A - B
- ☐ A * B
- ☐ A / B
- ☐ Remainder of (A / B)
- ☐ Modulus of (A / B)
- ☐ Equal to A
- ☐ sin (A / B)
- ☐ cos (A / B)
- ☐ tan (A / B)
- ☐ asin (A / B)
- ☐ acos (A / B)
- ☐ atan (A / B)

Angle Specification

- ☐ Angles in Radians
- ☐ Angles in Degrees

Output Header Field = Header Field A

None = None

Header Field B

None

OK Cancel

Parameter Description:

Type of operator — Select the mathematical operation that will be applied to the seismic trace header.

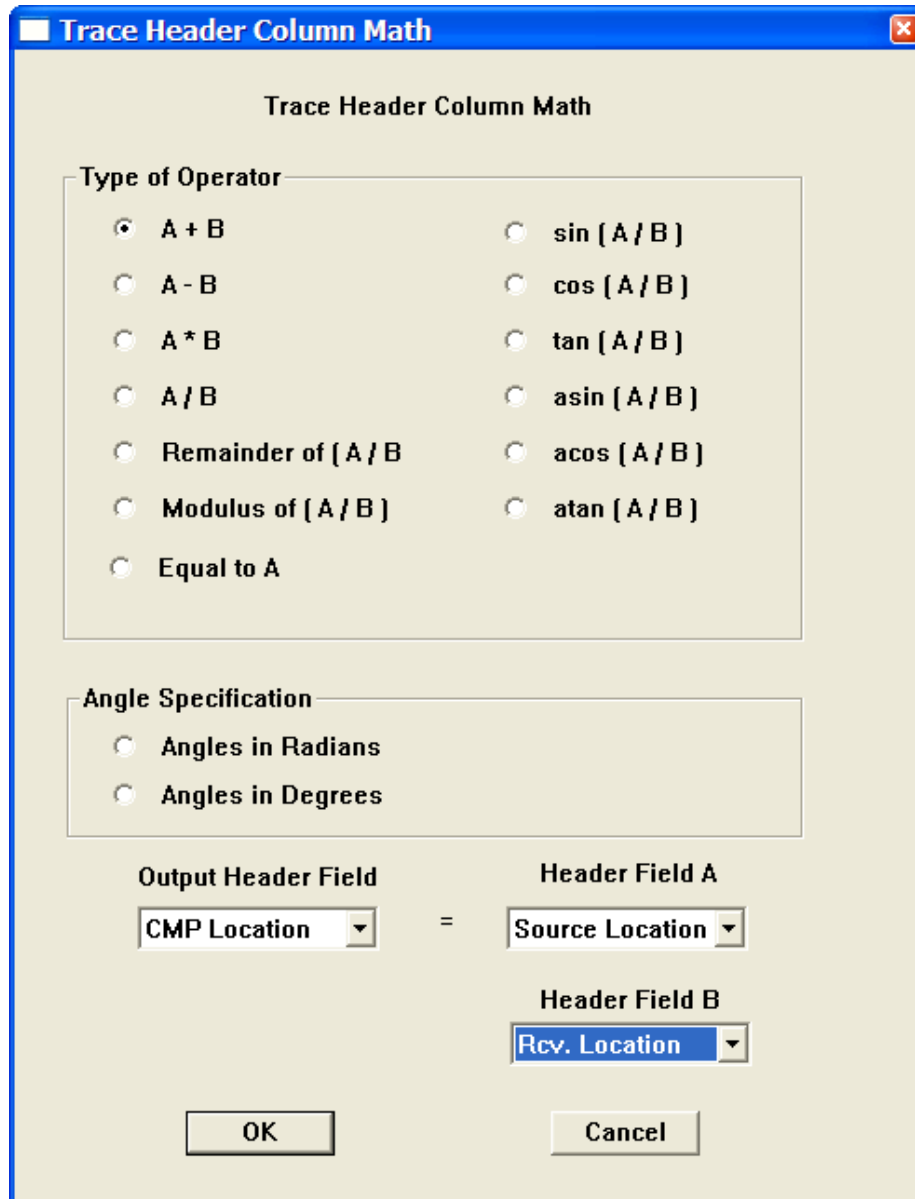
Angle Specification — If a trigonometric operation is to be performed, indicate whether the angles involved are measured in units of degrees or radians.

Output Header Field — Select the trace header field where the result of the operation will be output.

Header Field A — Select the first trace header field used in the operation

Header Field B — Select the second trace header field used in the operation

Example: Set the CMP Location equal to the sum of the Source Location and the Receiver Location.



The image shows a dialog box titled "Trace Header Column Math". It contains two main sections: "Type of Operator" and "Angle Specification".

Type of Operator

<input checked="" type="radio"/> A + B	<input type="radio"/> sin [A / B]
<input type="radio"/> A - B	<input type="radio"/> cos [A / B]
<input type="radio"/> A * B	<input type="radio"/> tan [A / B]
<input type="radio"/> A / B	<input type="radio"/> asin [A / B]
<input type="radio"/> Remainder of [A / B]	<input type="radio"/> acos [A / B]
<input type="radio"/> Modulus of [A / B]	<input type="radio"/> atan [A / B]
<input type="radio"/> Equal to A	

Angle Specification

<input type="radio"/> Angles in Radians
<input type="radio"/> Angles in Degrees

Output Header Field = **Header Field A**

<input type="text" value="CMP Location"/>	=	<input type="text" value="Source Location"/>
---	---	--

Header Field B

<input type="text" value="Rcv. Location"/>
--

OK Cancel

Trace Header Logic

Usage:

The Trace Header Logic step allows you modify the trace header values of a seismic trace using the relational operators and logic conditions characteristic of an If - Then – Else statement.

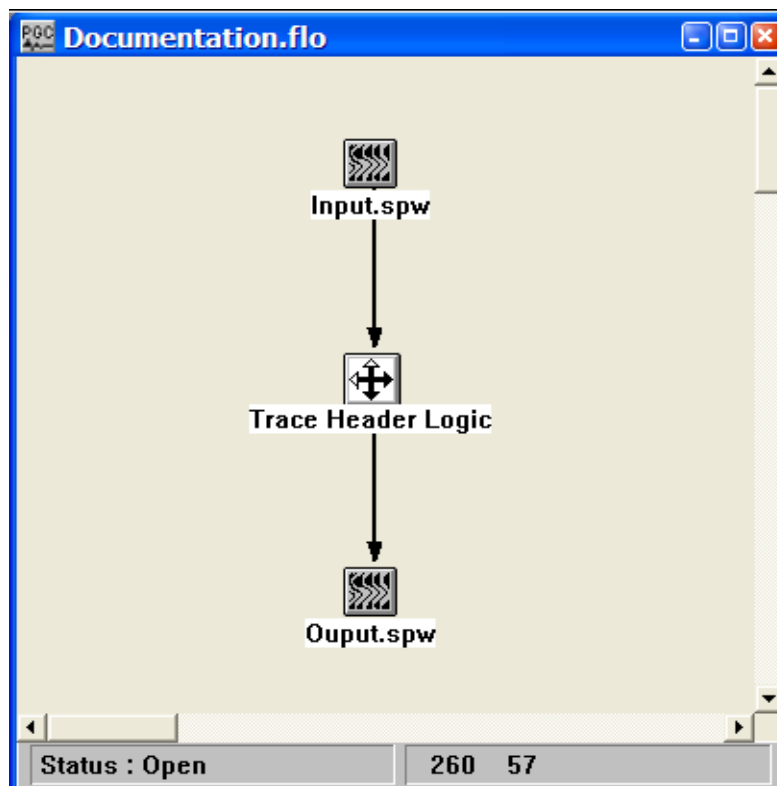
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Trace Header Logic

if

Header Field: Source Location Relation: > ☒ Header Field ☐ Constant or 0.0000

☒ Logic AND

Header Field: Offset Relation: > ☐ Header Field ☒ Constant or 0.0000

then

Header Field: User Def 1 = ☐ Header Field ☒ Constant or 1.0000

else

Header Field: User Def 1 = ☐ Header Field ☒ Constant or -1.0000

OK Cancel

Parameter Description:

if — Select the relational and logic conditions for which the then statement will be executed.

Header Field – Select the primary trace header field to be tested.

Relation – Select the primary relational operator

Header Field – If selected, the primary trace header field will be evaluated against the chosen header field using the primary relational operator.

Constant – If selected, the primary trace header field will be evaluated against the user-supplied constant using the primary relational operator.

Logic – If checked, the Logic option allows selection of a secondary header field using and/or logic.

Header Field – Select the secondary trace header field to be tested.

Relation – Select the secondary relational operator

Header Field – If selected, the primary trace header field will be evaluated against the chosen header field using the secondary relational operator.

Constant – If selected, the primary trace header field will be evaluated against the user supplied constant using the secondary relational operator.

then — Define the trace header operation to be performed in the case that the if conditions are satisfied.

Header Field – Select the trace header field to be modified in the case that the if conditions are satisfied.

Header Field – If selected, the header field selected above will be set equal to the chosen header field.

Constant – If selected, the header field selected above will be set equal to the user-supplied constant.

else — Define the trace header operation to be performed in the case that the if conditions are not satisfied.

Header Field – Select the trace header field to be modified in the case that the if conditions are not satisfied.

Header Field – If selected, the header field selected above will be set equal to the chosen header field.

Constant – If selected, the header field selected above will be set equal to the user-supplied constant.

Example: If the source-receiver azimuth is greater than or equal to zero, set the User Def 1 field equal to +1. Otherwise, set the User Def 1 field equal to -1.

Trace Header Logic

if

Header Field	Relation	<input type="radio"/> Header Field	<input checked="" type="radio"/> Constant
Azimuth Angle	>=	Rcv. Location	0.0000

☐ Logic

AND

Header Field	Relation	<input type="radio"/> Header Field	<input checked="" type="radio"/> Constant
Offset	>	None	0.0000

then

Header Field		<input type="radio"/> Header Field	<input checked="" type="radio"/> Constant
User Def 1	=	None	1.0000

else

Header Field		<input type="radio"/> Header Field	<input checked="" type="radio"/> Constant
User Def 1	=	None	-1.0000

OK Cancel

Trace Header Resequencing

Usage:

The Trace Header Resequencing step is used to modify trace header values based on changes in other trace header values.

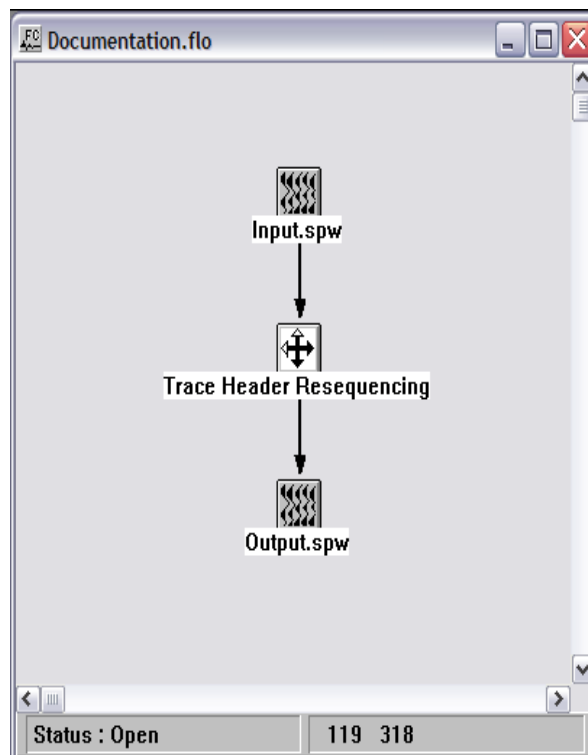
Input Links:

1) Seismic data in any sort order (mandatory).

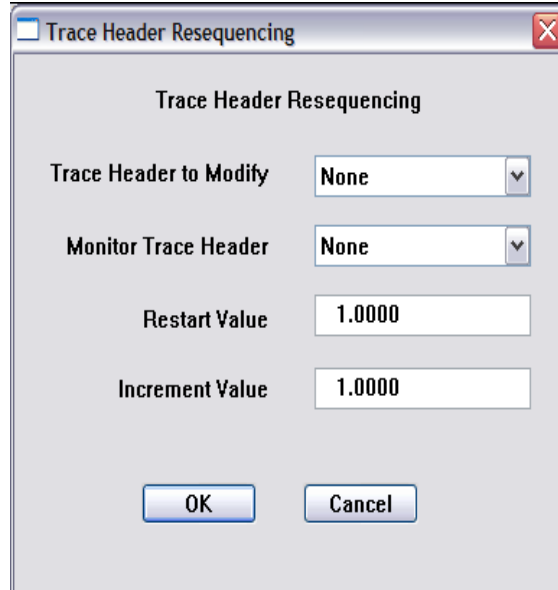
Output Links:

1) Seismic data file containing the duplicated trace (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Trace Header Resequencing". It has a standard title bar with a minimize button, a maximize button, and a close button (red X). The dialog box contains four labeled fields: "Trace Header to Modify" and "Monitor Trace Header", both of which are dropdown menus currently set to "None"; "Restart Value", a text box containing "1.0000"; and "Increment Value", a text box containing "1.0000". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Trace Header to Modify – Select the trace header field that will be modified.

Monitor Trace Header – Select the monitor trace header field. A change in value of the Monitor Trace Header will result in a change in value of the Trace Header to Modify based on the following two values:

Restart value — This value will be placed in the Trace Header to Modify whenever there is a change in the Monitor Trace Header.

Increment value — This value will be added to the Restart value for each trace header in which the Trace Header to Modify does not change.

Trace Math

Usage:

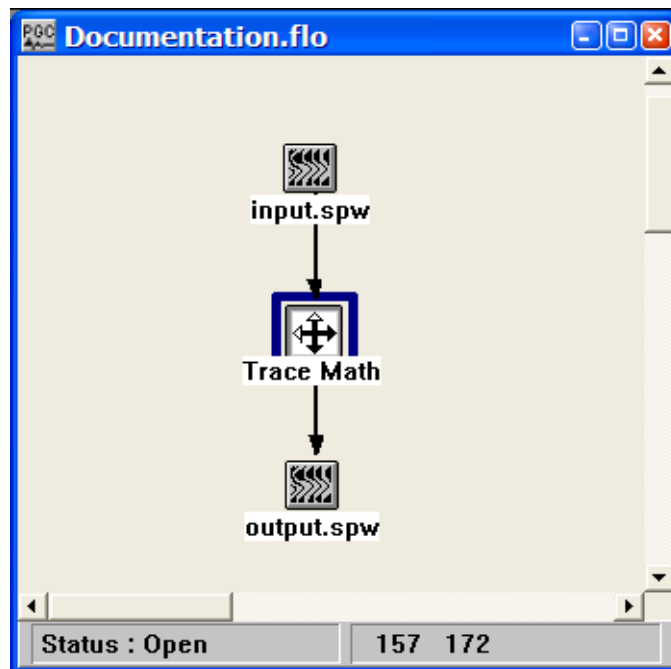
The Trace Math step allows you to apply various math operators the trace data amplitude values.

Input Links:

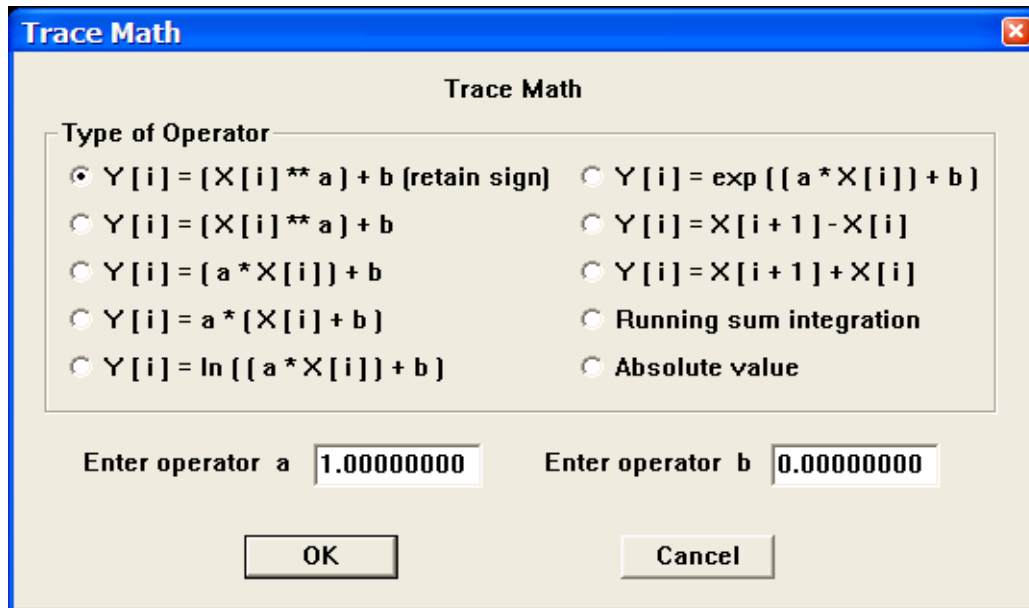
1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:

Step Parameter Dialog:



The image shows a software dialog box titled "Trace Math". It has a blue title bar with a close button in the top right corner. The main area is light beige and contains a group box labeled "Type of Operator". Inside this group box, there are ten radio button options arranged in two columns. The first option, $Y[i] = \{X[i]^{**} a\} + b$ (retain sign), is selected. Below the group box, there are two text input fields: "Enter operator a" with the value "1.00000000" and "Enter operator b" with the value "0.00000000". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Trace Math

Type of Operator

- ☒ $Y[i] = \{X[i]^{**} a\} + b$ (retain sign)
- ☐ $Y[i] = \exp \{ [a * X[i]] + b \}$
- ☐ $Y[i] = \{X[i]^{**} a\} + b$
- ☐ $Y[i] = X[i + 1] - X[i]$
- ☐ $Y[i] = \{a * X[i]\} + b$
- ☐ $Y[i] = X[i + 1] + X[i]$
- ☐ $Y[i] = a * \{X[i] + b\}$
- ☐ Running sum integration
- ☐ $Y[i] = \ln \{ [a * X[i]] + b \}$
- ☐ Absolute value

Enter operator a Enter operator b

Parameter Description:

Type of operator — Select the equation to that will be applied to the seismic data trace amplitude values.

Enter operator a — Enter the value for the parameter a in the equations.

Enter operator b — Enter the value for the parameter b in the equations.

Vibroseis Correlation

Usage:

The Vibroseis Correlation step cross correlates uncorrelated seismic data acquired with the Vibroseis™ method with the corresponding vibroseis sweep. The correlated output data should be considered zero phase.

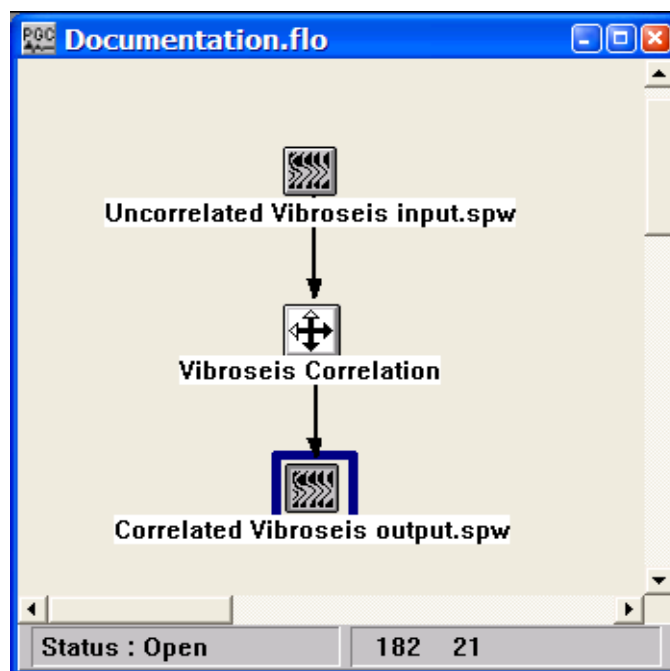
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data — Vibroseis™ pilot sweeps (optional).

Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Vibroseis Correlation

Pilot length (ms)

☐ Minimum phase compensate data

☐ Extended correlation

Output trace length (ms)

Aux SPW seismic file name :
C:\Data\Example Data\Vibroseis pilot.spw

Signature Input Options

☒ One pilot per record from auxiliary file

☐ One pilot per trace from auxiliary file

☐ One pilot per record from data file

Sweep trace number

First trace to kill

Last trace to kill

Parameter Description:

Pilot length (ms) — Enter the length of the pilot sweep in milliseconds.

Minimum phase compensate data — If checked, a minimum phase compensation filter will be calculated and applied so that the correlated data will be minimum phase on output.

Extended Correlation — If checked, an extended correlation will be done using the entered trace output length.

Output trace length (ms) — Enter the output length of the result of the cross correlation.

Signature Input Options — Select the method of accessing the Vibroseis pilot sweep.

Auxiliary SPW seismic file – Select the seismic file that contains the Vibroseis pilot.

One pilot per record from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential record. Therefore, number of pilot traces should equal the number of input records.

One pilot per trace from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential trace. Therefore, number of pilot traces should equal the number of input traces.

One pilot per record in the data file — This option uses one trace from the each of the uncorrelated input records as the pilot trace for that record.

Sweep trace number — Enter the trace number to use as the pilot sweep.

First trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill the these auxiliary traces so that the do not appear on output. Enter the first trace number to kill.

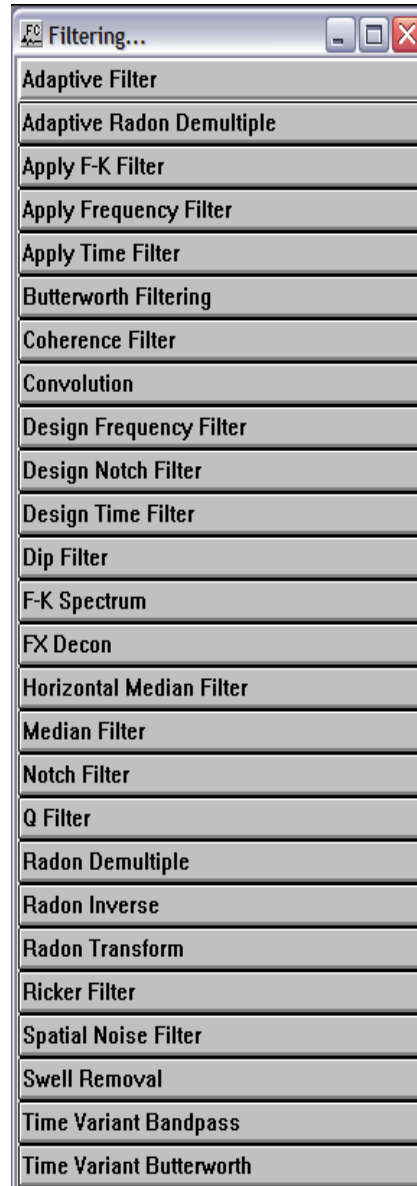
Last trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill the these auxiliary traces traces so that the do not appear on output. Enter the last trace number to kill.

Browse — Select this button to set the input auxiliary file containing the pilot traces.

Filtering Steps

This section documents the processing steps available in the Filtering Steps category.

Processing steps currently available are:



Adaptive Filter

Usage:

The Adaptive Filter step is currently under development.

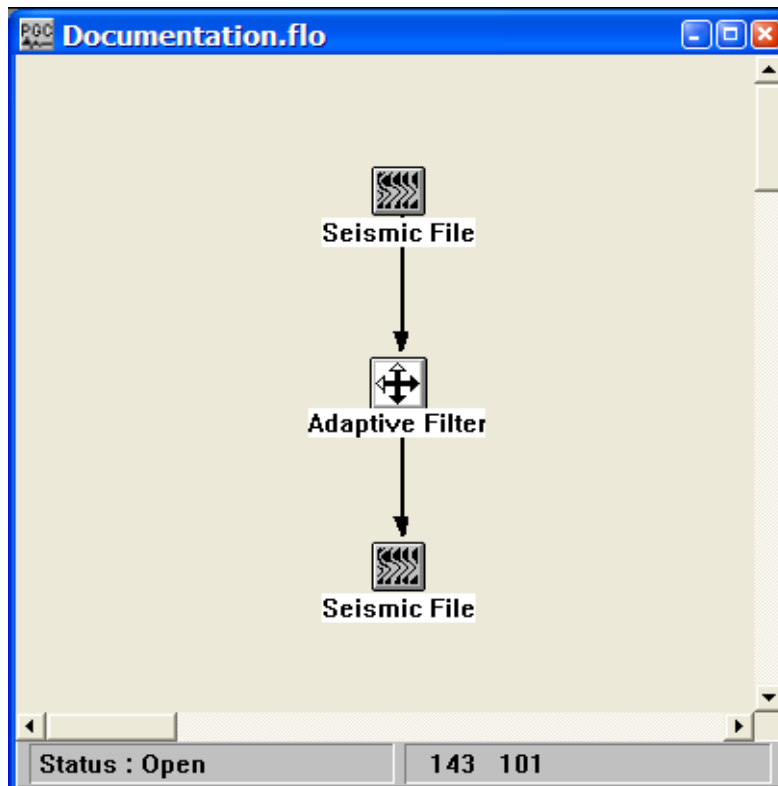
Input Links:

- 1) Seismic data in any sort order (mandatory).

Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Adaptive Filter

Filter parameters

Filter length: 65

Filter coefficient: 0.010

Number of iterations: 1

Output type

☒ Output filtered trace

☐ Output raw filter coefficients

Window

☐ Use window

Taper length: 200

Window start (ms): 0.0

Window length (ms): 200.0

Bandpass filter

☐ Use bandpass filter

Lo cut: 10.0

Lo pass: 20.0

Hi pass: 70.0

Hi cut: 80.0

☒ Zero weights every trace

SPW format noise trace file:

Parameter Description:

Filter parameters -

Filter length —.

Filter coefficient —

Number of iterations —

Window — If the Use window box is checked, the following window parameters will be applied.

Taper length —.

Window start (ms) —

Window length (ms) —

Output type -

Output filtered traces—.

Output raw filter coefficients —

Bandpass filter -

Lo cut —.

Lo pass —

High pass —

High cut —

Adaptive Radon Demultiple

Usage:

The Adaptive Radon Demultiple step performs parabolic radon demultiple through a modeling of primaries, multiples, and noise in the parabolic radon domain followed by subtraction of multiples and noise in the time domain. You specify the transform type, the range of ray parameters in the output transform, a percentage of multiples plus noise to subtract, and the spatial and temporal taper lengths used to generate the transform.

Input Links:

1) Seismic data in any sort order (mandatory).

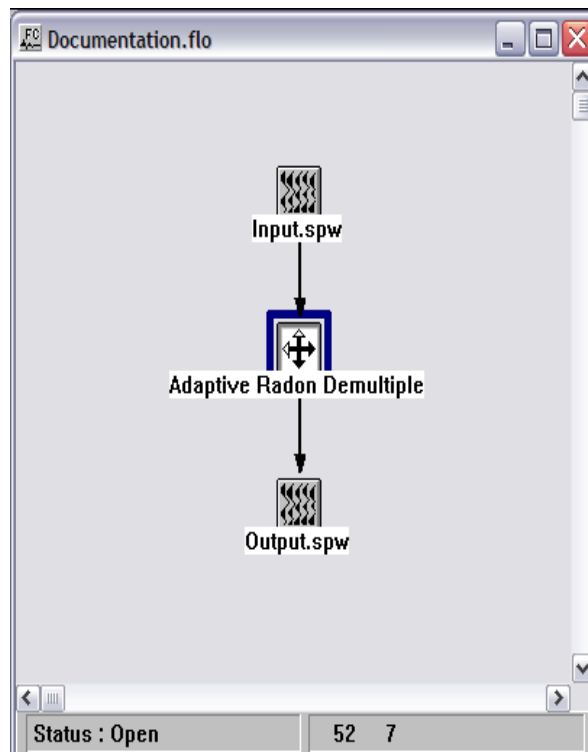
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

Hampson, D., 1991, Inverse velocity stacking for multiple elimination, Journal of the Canadian Society of Exploration Geophysics, **22**, p. 44-55.

Example Flowchart:



Step Parameter Dialog:

Adaptive Radon Demultiple

Model moveout

Minimum differential moveout -32.0

Maximum differential moveout 500.0

Minimum multiple moveout 100.0

Ray parameters

☐ Set number of ray parameters

Number of ray parameters 200

Percent add-back 100.0

Percent pre-whitening 20.0

Minimum live traces 5

OK Cancel

Parameter Description:

Model moveout — Set the range of parabolas that will generate the primary and multiple models.

Minimum differential moveout – Set the minimum differential moveout, expressed in milliseconds on the far-offset trace. The primary model is generated with parabolas from the <minimum differential moveout> to the <minimum multiple moveout>.

Maximum differential moveout – Set the maximum differential moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Minimum multiple moveout – Set the minimum multiple moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

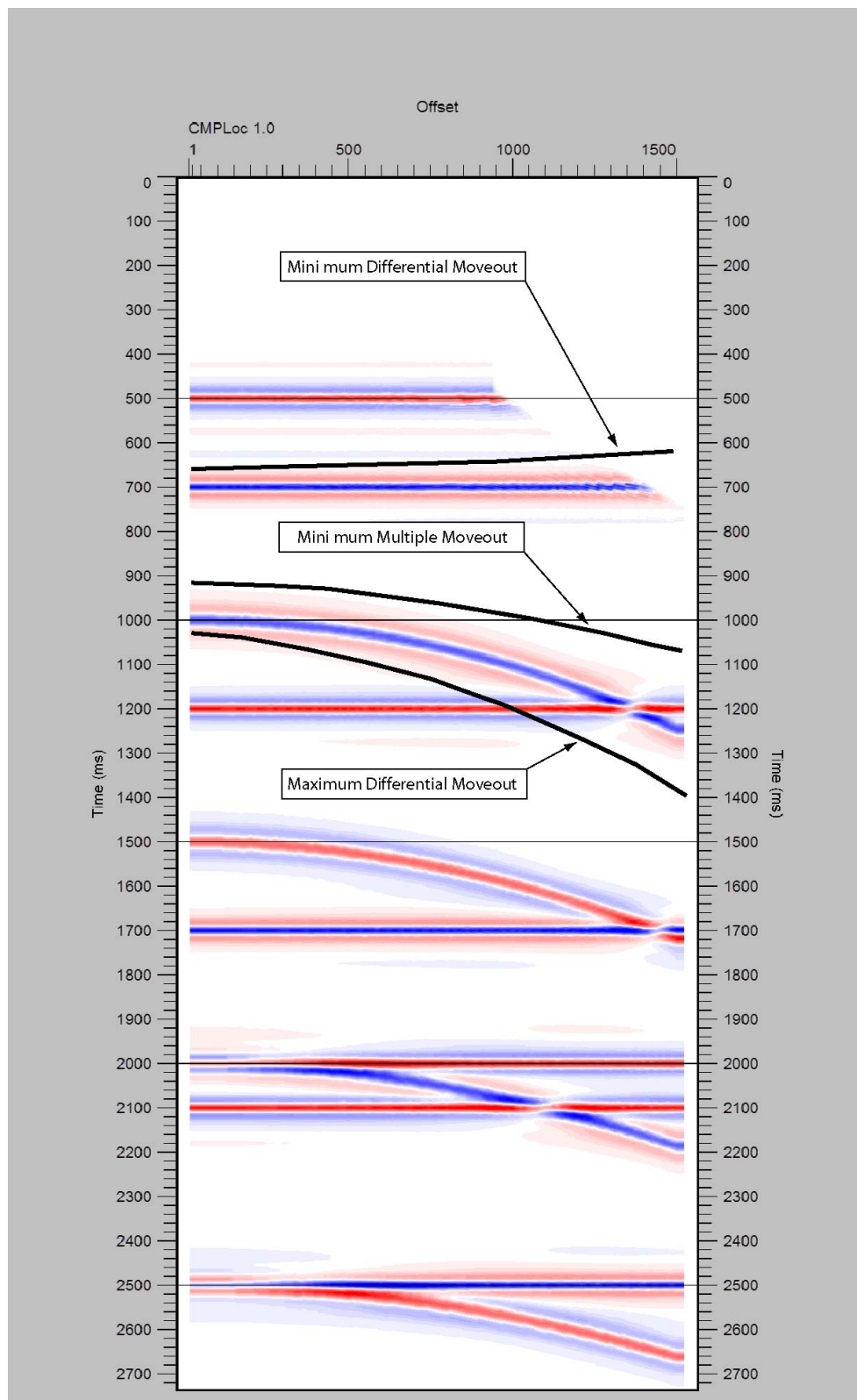
Set number of ray parameters — If checked, the number of ray parameters is determined manually. By default, the number of ray parameters is determined internally.

Number of ray parameters – set the number of ray parameter.

Percent add-back – Enter the percentage of the multiple + noise model to be subtracted from the input gather.

Percent pre-whitening – Enter the amount of pre-whitening used to stabilize the least-squares inversion in the presence of noise.

Minimum live traces – Enter the minimum number of live traces that must be present in a gather in order to transform that gather.



Apply F-K Filter

Usage:

The Apply F-K Filter step transforms T-X domain data to the F-K domain, applies a specified F-K reject filter, and returns the data to the T-X domain. F-K Filters are picked interactively as Surgical Mutes in SeisViewer using the Pick Traces tool located in the Picking menu.

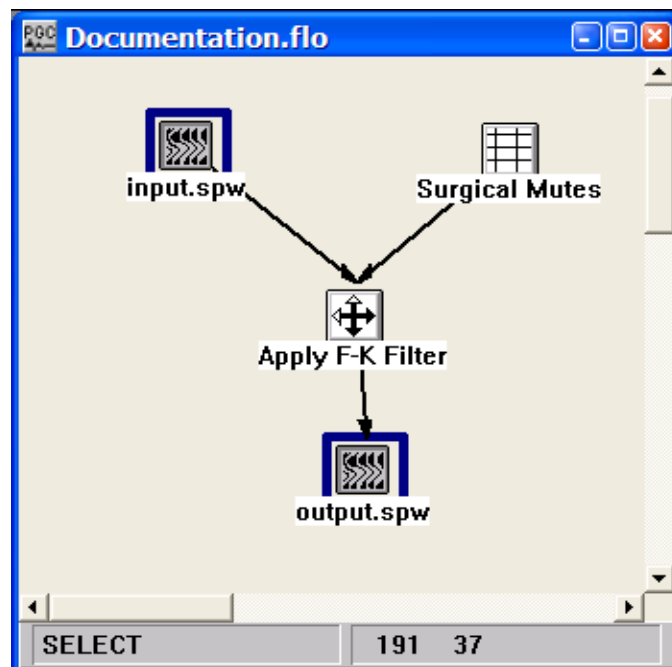
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Surgical Mutes cards (mandatory).

Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:

Apply F-K Filter

Mute Taper Type

☒ Hanning ☐ Hamming
☐ Blackman ☐ No taper

Mute taper length [samples]

Trace Amplitude Definition

☐ Use relative amplitude traces
☒ Use true amplitude traces

Mute Interpolation Control

☒ Filter #1
☐ Filter #2
☐ Filter #3
☐ Filter #4

☐ Extend the trace (k) dimension
Enter the extended number

☒ AGC before filter

OK **Cancel**

Parameter Description:

Mute Taper Type — Select the type of taper to use when applying the F-K mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos(2 * \pi * n / N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos(2 * \pi * n / N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos(2 * \pi * n / N) + 0.08 * \cos(4 * \pi * n / N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Trace Amplitude Definition — Select the trace amplitude type to use, True or Relative.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Mute Interpolation Control — Set the interpolation mode for each of the F-K mutes. Note: Turning off the interpolation will filter only the records associated with the picked F-K mutes. Only one filter is currently available in the current release of SPW.

Filter # 1 — If checked, the first filter will be interpolated between picked control points.

Filter # 2 — If checked, the first filter will be interpolated between picked control points.

Filter # 3 — If checked, the first filter will be interpolated between picked control points.

Filter # 4 — If checked, the first filter will be interpolated between picked control points.

Extend the trace (k) dimension — If checked, the trace dimension may be extended (padded) to help reduce Fourier wrap around effects.

Enter the extended number — Enter the number of traces to extend (pad) in the trace direction for the 2-D FFT.

AGC before filter — If checked, an AGC is applied to each trace before filtering. The AGC gain function is removed after filtering.

Apply F-K Velocity Filter

Usage:

The Apply F-K Velocity Filter step transforms T-X domain data to the F-K domain, applies an F-K pass or reject filter, and returns the data to the T-X domain. A user-specified minimum and maximum velocity defines the pass or reject zone. **Note:** the step is currently under construction.

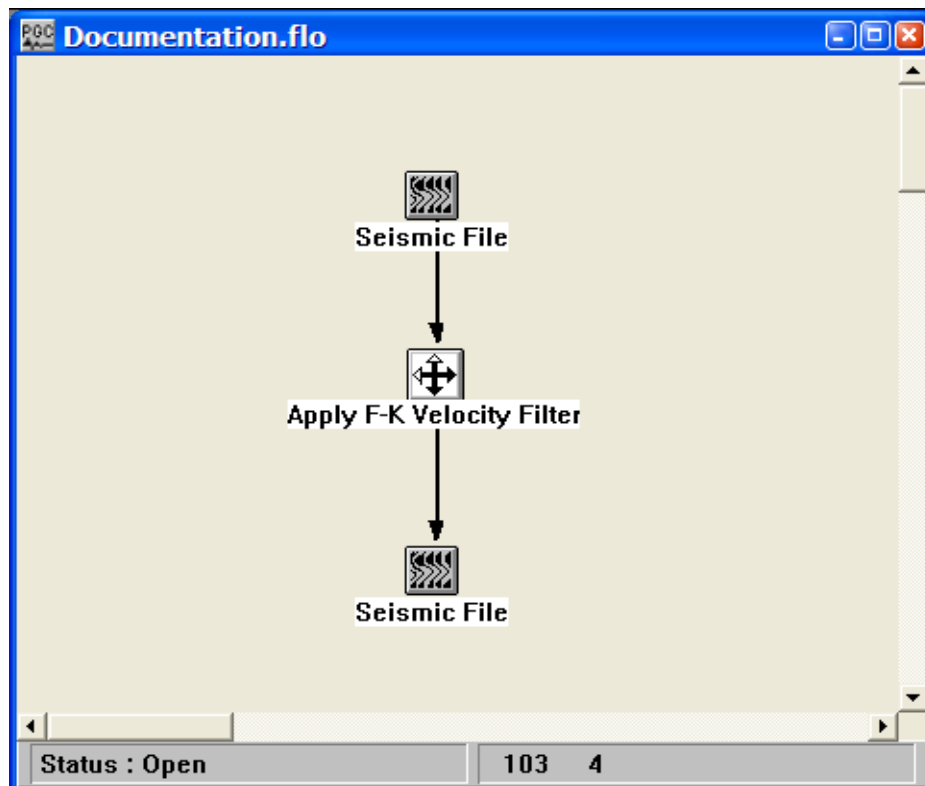
Input Links:

1) Seismic data in any sort order (mandatory).

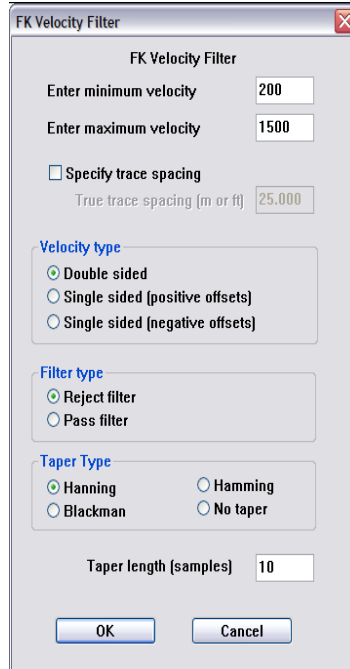
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "FK Velocity Filter". It contains several input fields and radio button groups. The "Enter minimum velocity" field is set to 200, and the "Enter maximum velocity" field is set to 1500. There is a checkbox for "Specify trace spacing" which is currently unchecked; below it, the "True trace spacing (m or ft)" field is set to 25.000. The "Velocity type" section has three radio buttons: "Double sided" (selected), "Single sided (positive offsets)", and "Single sided (negative offsets)". The "Filter type" section has two radio buttons: "Reject filter" (selected) and "Pass filter". The "Taper Type" section has four radio buttons: "Hanning" (selected), "Blackman", "Hamming", and "No taper". At the bottom, the "Taper length (samples)" field is set to 10. There are "OK" and "Cancel" buttons at the very bottom.

Parameter Description:

Enter minimum velocity – Specify the minimum velocity of the pass or reject zone.

Enter maximum velocity – Specify the maximum velocity of the pass or reject zone.

Specify trace spacing – Check this box to manual set the trace-to-trace spacing in the gather to be filtered. By default, the group interval is read from the seismic data and the trace-to-trace spacing is calculated from the group interval. If the Geometry Definition step has not been applied to the data, the seismic data will not contain information regarding the group interval and this option should be used.

Velocity type – Specify whether the applied F-K filter will be symmetrical or asymmetrical.

Double sided — The specified minimum and maximum velocities will be used to create a double-sided, or symmetrical F-K filter.

Single sided (positive offsets) — The specified minimum and maximum velocities will be used to pass or reject energy propagating in the direction of increasingly positive source-to-receiver offset.

Single sided (negative offsets) — The specified minimum and maximum velocities will be used to pass or reject energy propagating in the direction of increasingly negative source-to-receiver offset.

Filter type – Specify whether the minimum and maximum velocity values specify a pass or a reject zone.

Reject filter — The portion of F-K space defined by the minimum and maximum velocities will be rejected.

Pass filter — The portion of F-K space defined by the minimum and maximum velocities will be passed.

Taper Type — Select the type of taper to use when applying the F-K mute function.

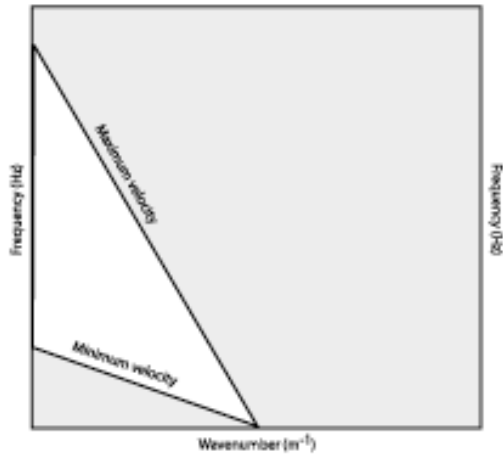
Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos(2\pi n/N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos(2\pi n/N)$.

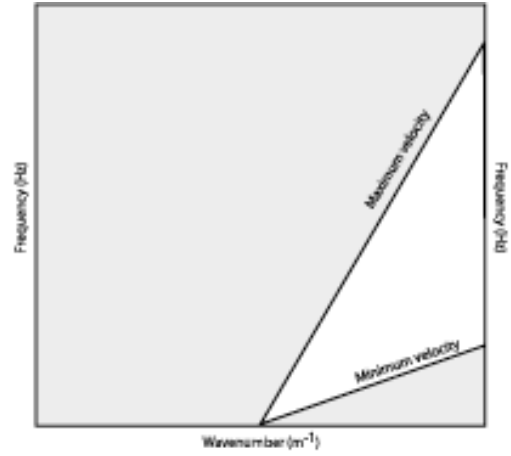
Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos(2\pi n/N) + 0.08 * \cos(4\pi n/N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

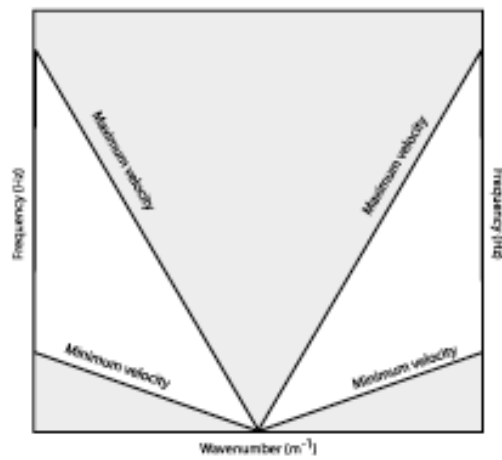
Taper length (ms)— Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.



Single-sided (negative offsets)



Single-sided (positive offsets)



Double-sided

Types of FK Velocity filters.

Apply Frequency Filter

Usage:

Apply the input frequency filter card to the seismic data.

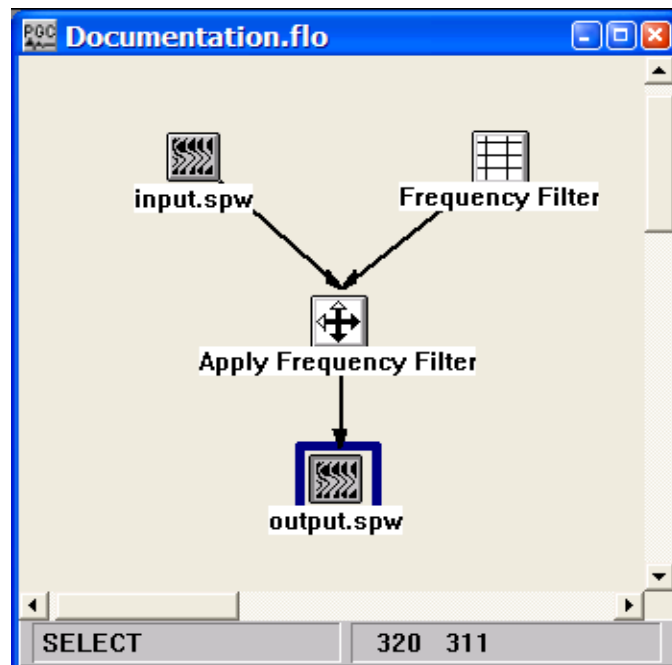
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Frequency Filter cards (mandatory).

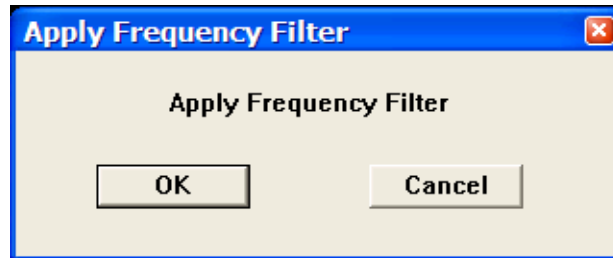
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this process.

Apply Time Filter

Usage:

Apply the input time filter card to the seismic data.

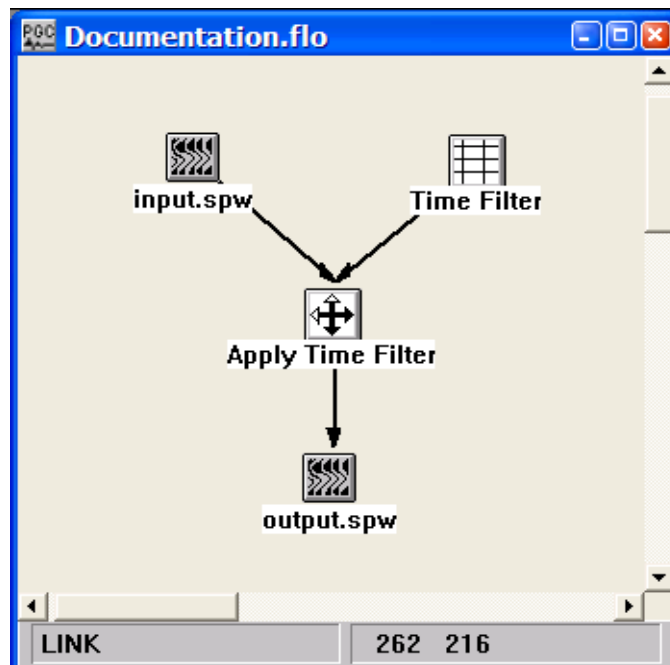
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Time Filter cards (mandatory).

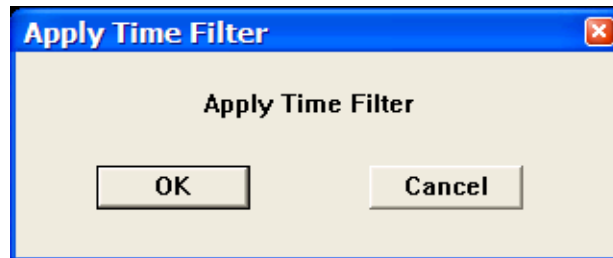
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this process.

Butterworth Filtering

Usage:

The Butterworth Filtering step allows you to apply recursively a Butterworth filter to your trace data in the time domain. You specify the low pass, high pass and high and low rolloff rates in decibels (dB) for the filter. You may choose to apply the filter as either a zero phase or minimum phase filter.

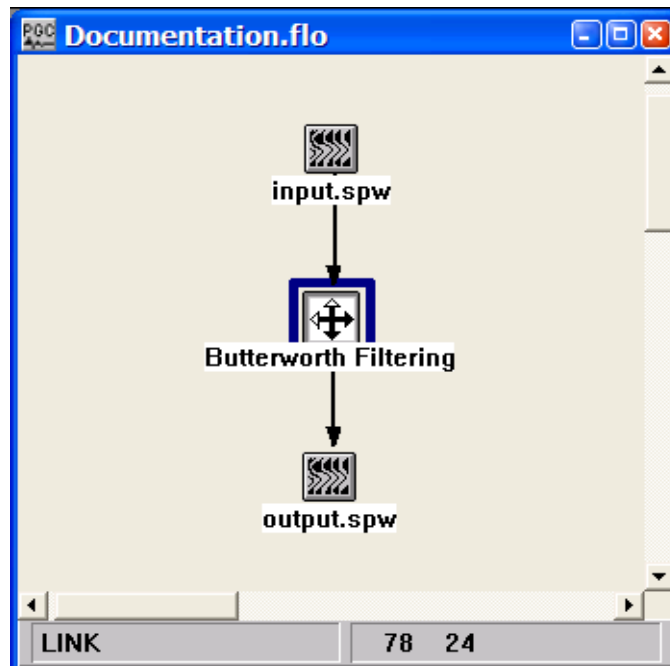
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Butterworth Filtering

☒ Low cut

Low frequency (Hz)

Low rolloff rate (dB/oct)

☒ High cut

High frequency (Hz)

High rolloff rate (dB/oct)

Phase Selection

☒ Zero ☐ Minimum

OK Cancel

Parameter Description:

Low cut — Check this box to attenuate low frequencies. If unchecked, a low cut filter will not be applied to your data.

Low frequency — Enter the low half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

Low rolloff rate — Enter the low rolloff filter slope in decibels per octave (dB/Octave) to be applied to your data. Higher numbers give steeper rolloff.

High cut — Check this box to attenuate high frequencies. If unchecked, a high cut filter will not be applied to your data.

High frequency — Enter the high half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

High rolloff rate — Enter the high rolloff filter slope in decibels per octave (dB/Octave) to be applied to your data. Higher numbers give steeper rolloff.

Phase selection — Select the phase type of the filter.

Zero — Zero phase filter selected.

Minimum — Minimum phase filter selected.

Coherence Filter

Usage:

The Coherence filter is used to accentuate the visual coherence of seismic events.

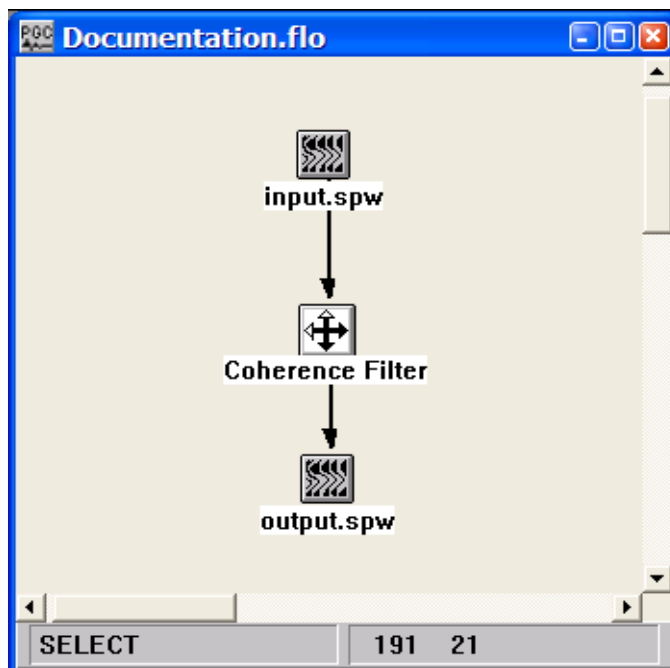
Input Links:

1) Seismic data in any sort order (mandatory).

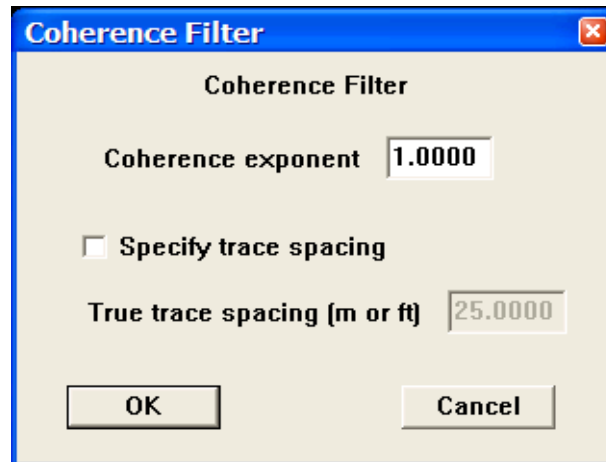
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

A screenshot of a software dialog box titled "Coherence Filter". The dialog has a blue title bar with a close button (X) in the top right corner. The main area is light beige. It contains a label "Coherence exponent" followed by a text input field containing "1.0000". Below this is a checkbox labeled "Specify trace spacing", which is currently unchecked. Under the checkbox is a label "True trace spacing (m or ft)" followed by a text input field containing "25.0000". At the bottom are two buttons: "OK" on the left and "Cancel" on the right.

Coherence Filter

Coherence exponent

☐ Specify trace spacing

True trace spacing (m or ft)

Parameter Description:

Coherence Exponent — Enter the coherency filter exponent. Values of 1 to 1.5 are usually used. A value of 1 does nothing. A value of 1.5 significantly increases coherency.

Specify trace spacing – If checked, allows manual entry of the trace-to-trace spacing.

True trace spacing – Entry the trace-to-trace spacing of the input record.

Convolution

Usage:

The Convolution step is used to convolve traces in an seismic data file with a filter function specified in an auxiliary data set.

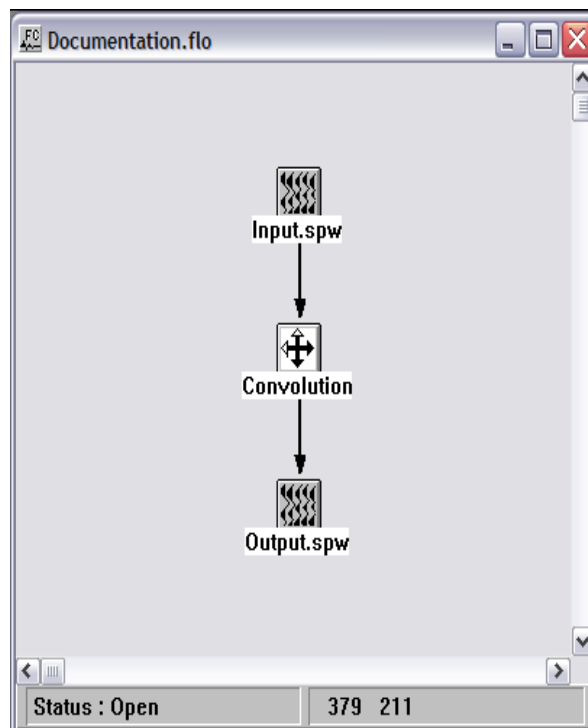
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Auxiliary file in any sort order (mandatory).

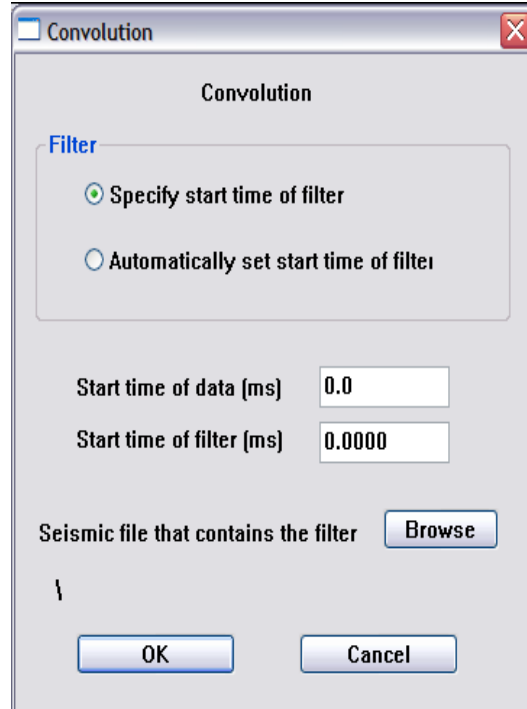
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a 'Convolution' dialog box with a title bar containing a minimize button, the text 'Convolution', and a close button. The dialog has a 'Filter' section with two radio buttons: 'Specify start time of filter' (selected) and 'Automatically set start time of filter'. Below this are two text input fields: 'Start time of data (ms)' with the value '0.0' and 'Start time of filter (ms)' with the value '0.0000'. There is a label 'Seismic file that contains the filter' followed by a 'Browse' button. At the bottom are 'OK' and 'Cancel' buttons.

Parameter Description:

Filter

Specify start time of filter -.

Automatically set start time of filter -.

Start time of data – Specify the time at which to start convolving the input data with the filter.

Start time of filter – Specify the time-zero of the filter if the “Specify start time of filter” option is being used.

Seismic file that contains filter – Use the Browse button to locate the seismic file that contains the filter.

Derivative

Usage:

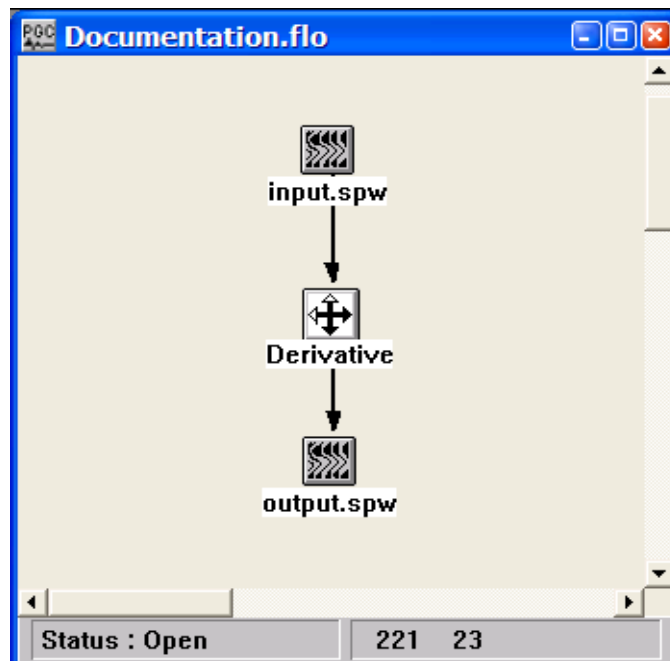
The Derivative step computes the derivative of the data samples in each input seismic trace.

Input Links:

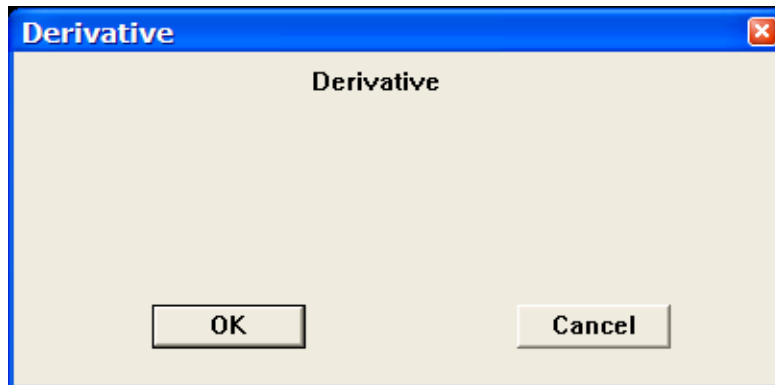
1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Diffusion Filter

Usage:

The Diffusion filter is a noise reduction filter based on the diffusion equation. An option exists to calculate a continuity factor that inhibits diffusion across edges.

Input Links:

1) Seismic data in any sort order (mandatory).

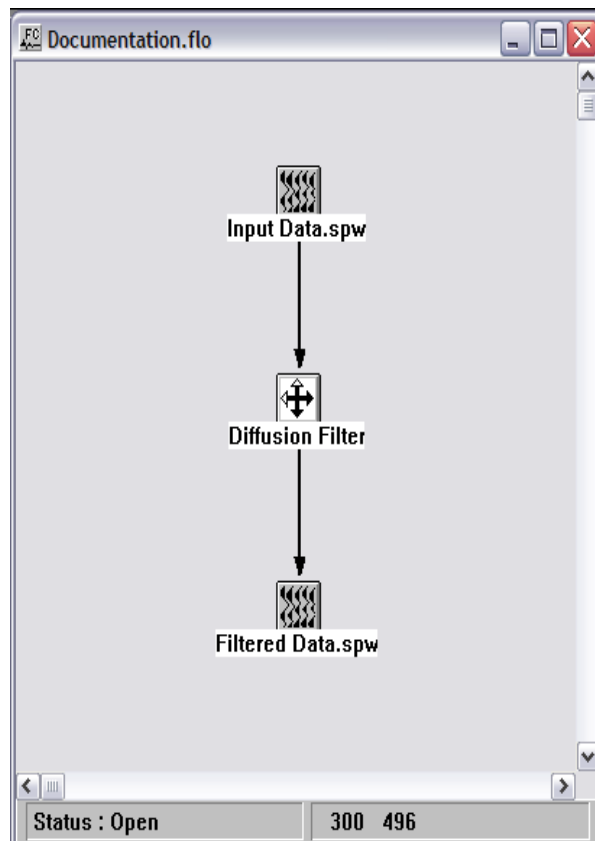
Output Links:

1) Seismic data in any sort order (mandatory).

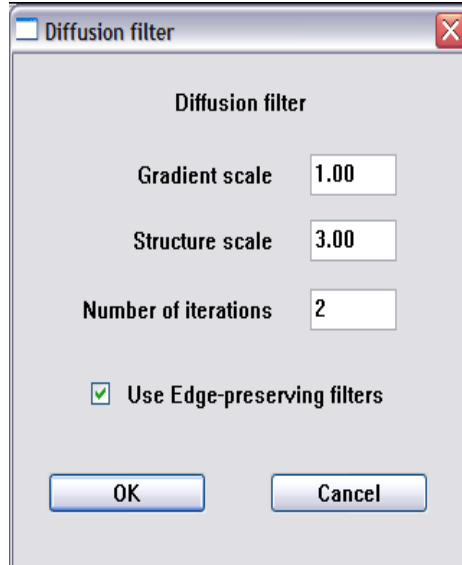
Reference:

Fehmers, G.C, and Hocker, C.F.W., 2003, Fast structural interpretation with structure-oriented filters, Geophysics, vol. 68, no. 4, p. 1286-1293.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Gradient scale — Standard deviation of 2D Gaussian filter used for smoothing the input data prior to gradient calculation.

Structure scale — Standard deviation of 2D Gaussian filter used for smoothing the gradient tensors prior to eigendecomposition.

Number of iterations — Number of filter iteration to apply to the input data.

Use Edge-preserving filters — If check, a continuity (coherence) factor is calculated that inhibits diffusion across edges.

Dip Filter

Usage:

The Dip Filter step allows you to apply a double-sided, or symmetric dip filter to your data. You designate whether you want to pass or reject in the filter zone. The pass or reject zone can be specified as milliseconds per trace or in velocity. The number of poles controls the steepness of your filter. The higher the number of poles, the steeper the slopes on your filter. You may also enter a maximum frequency to pass or reject. To specify your filter in terms of velocity, trace headers with valid offsets and a valid group interval are required.

Input Links:

1) Seismic data in any sort order (mandatory).

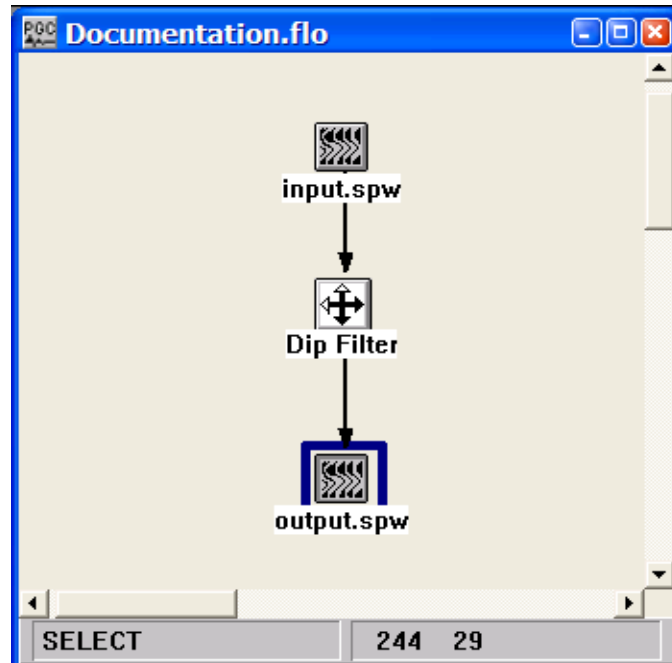
Output Links:

1) Seismic data in any sort order (mandatory).

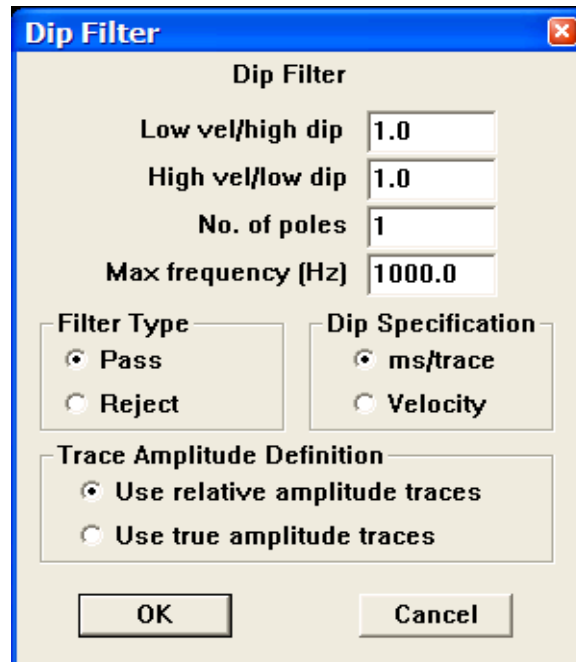
Reference:

Hale, D., and Claerbout, J., 1983, Butterworth dip filters, Geophysics, vol. 48, no. 8, p. 1033-1038.

Example Flowchart:



Step Parameter Dialog:



The image shows a 'Dip Filter' dialog box with a blue title bar and a close button. The dialog contains several input fields and radio button groups. The 'Low vel/high dip' field is set to 1.0, the 'High vel/low dip' field is set to 1.0, the 'No. of poles' field is set to 1, and the 'Max frequency (Hz)' field is set to 1000.0. There are two groups of radio buttons: 'Filter Type' with 'Pass' selected and 'Reject' unselected; and 'Dip Specification' with 'ms/trace' selected and 'Velocity' unselected. Below these is a 'Trace Amplitude Definition' group with 'Use relative amplitude traces' selected and 'Use true amplitude traces' unselected. At the bottom are 'OK' and 'Cancel' buttons.

Dip Filter	
Low vel/high dip	1.0
High vel/low dip	1.0
No. of poles	1
Max frequency (Hz)	1000.0
Filter Type	
<input checked="" type="radio"/> Pass	
<input type="radio"/> Reject	
Dip Specification	
<input checked="" type="radio"/> ms/trace	
<input type="radio"/> Velocity	
Trace Amplitude Definition	
<input checked="" type="radio"/> Use relative amplitude traces	
<input type="radio"/> Use true amplitude traces	
OK Cancel	

Parameter Description:

Low vel/hi dip — Enter the steeper dip (ms/trace) or the lower apparent velocity (distance units/sec). The filter is identical for negative dips. Be sure to select the appropriate dip specification button below.

Hi vel/low dip — Enter the shallower dip (ms/trace) or the higher apparent velocity (distance units/sec). The filter is identical for negative dips. Be sure to select the appropriate dip specification button below.

No. of poles — Enter the number of poles to define the filter slope. The larger the number of poles the steeper the filter rolloff slope.

Max frequency — You can specify a maximum frequency to pass or reject. Set this to a very large number to extend the filter to Nyquist frequency.

Filter Type — Select whether to pass or reject the specified range of dips.

Pass — Pass the range of dips.

Reject — Reject the range of dips.

Dip Specification — Select whether the dips are specified in ms/trace or distance units/sec. If distance units/sec is selected, the group interval is used as the trace spacing. Thus, valid trace headers must exist for the data.

Ms/trace — Interpret the dips specified above as units of ms/trace.

Velocity — Interpret the dips specified above as distance units/sec.

Trace Amplitude Definition — Select the trace amplitude type to use.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

F-K Spectrum

Usage:

The F-K Spectrum step allows you to create F-K spectrum image plots of your seismic data for designing F-K filters. Alternatively, the F-K spectrum can be directly created in SeisViewer from a selected seismic file.

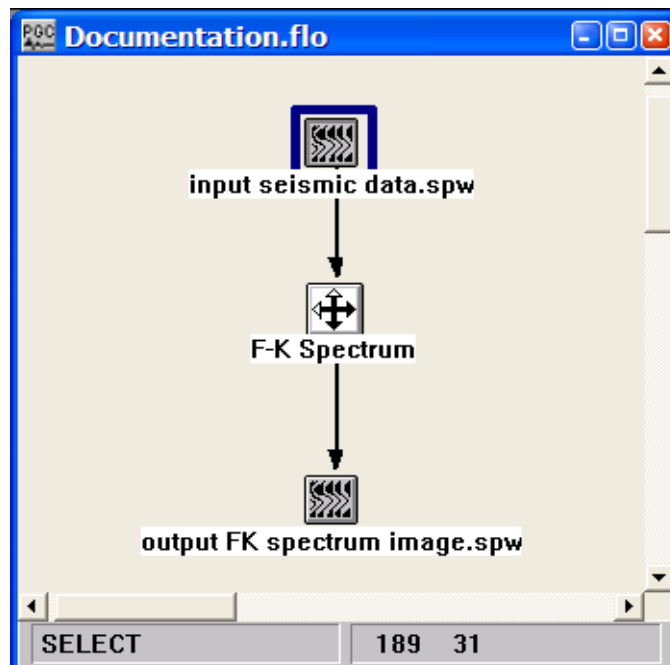
Input Links:

1) Seismic data in any sort order (mandatory).

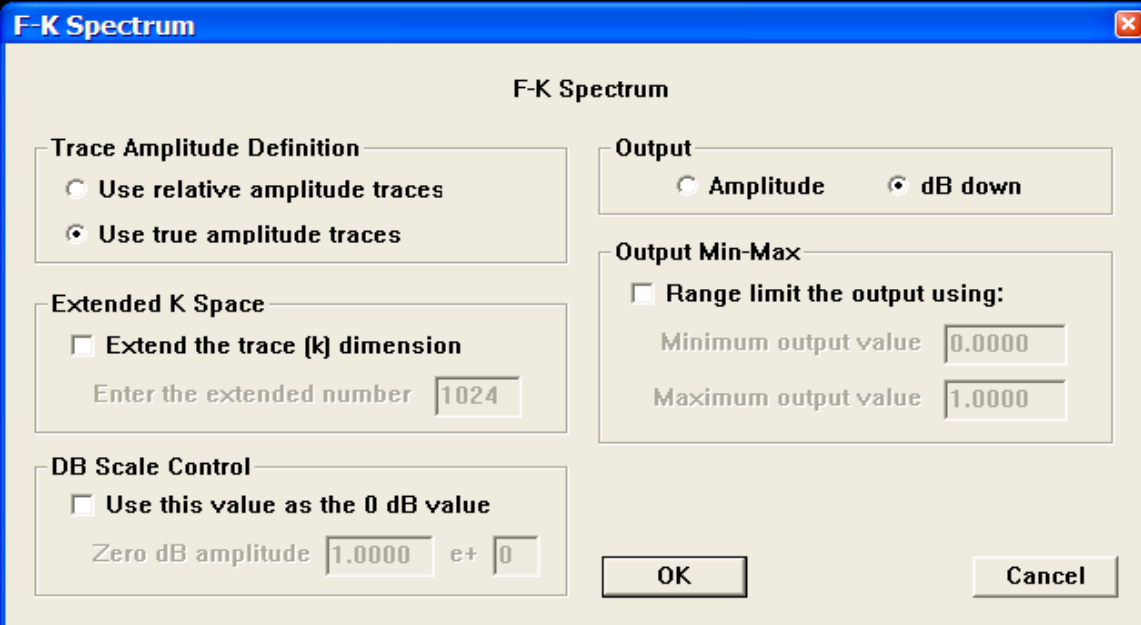
Output Links:

1) Seismic data containing F-K spectrum (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "F-K Spectrum". It contains several sections for configuring the analysis. The "Trace Amplitude Definition" section has two radio buttons: "Use relative amplitude traces" and "Use true amplitude traces", with the latter selected. The "Extended K Space" section has a checkbox "Extend the trace (k) dimension" which is unchecked, and a text input field "Enter the extended number" with the value "1024". The "DB Scale Control" section has a checkbox "Use this value as the 0 dB value" which is unchecked, and a text input field "Zero dB amplitude" with the value "1.0000" and a multiplier "e+ 0". The "Output" section has two radio buttons: "Amplitude" and "dB down", with the latter selected. The "Output Min-Max" section has a checkbox "Range limit the output using:" which is unchecked, and two text input fields: "Minimum output value" with "0.0000" and "Maximum output value" with "1.0000". At the bottom right are "OK" and "Cancel" buttons.

F-K Spectrum

Trace Amplitude Definition

☐ Use relative amplitude traces

☒ Use true amplitude traces

Extended K Space

☐ Extend the trace (k) dimension

Enter the extended number

DB Scale Control

☐ Use this value as the 0 dB value

Zero dB amplitude e+

Output

☐ Amplitude ☒ dB down

Output Min-Max

☐ Range limit the output using:

Minimum output value

Maximum output value

OK **Cancel**

Parameter Description:

Trace Amplitude Definition — Select the amplitude to use as input to the F-K transform, either relative or true amplitude.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Extend the trace (k) dimension — If checked, the trace dimension may be extended (padded) to help reduce Fourier wrap around effects.

Enter the extended number — Enter the number of traces to extend (pad) in the trace direction for the 2-D FFT.

dB scale control — If checked, the zero dB amplitude value may be entered. Using this option allows you to compare two dB scale images.

Output — Select the output amplitude scale, either absolute amplitude or dB down from the maximum.

Output min - max — If this option is on, the output amplitude values may be range limited by the input values. Again this is useful for comparisons.

F-X Deconvolution

Usage:

The FX Deconvolution step is a 2D multi-channel noise filter designed to attenuate random noise. This time-variant, adaptive filter removes the non-predictable part of the data using the assumption that the signal portion of the data is predictable and the noise portion of the data is inherently random, and therefore non-predictable. You specify the length of the filter window, in samples, the width of the filter window, in traces, and the filter adaptation percent.

Input Links:

1) Seismic data in any sort order (mandatory).

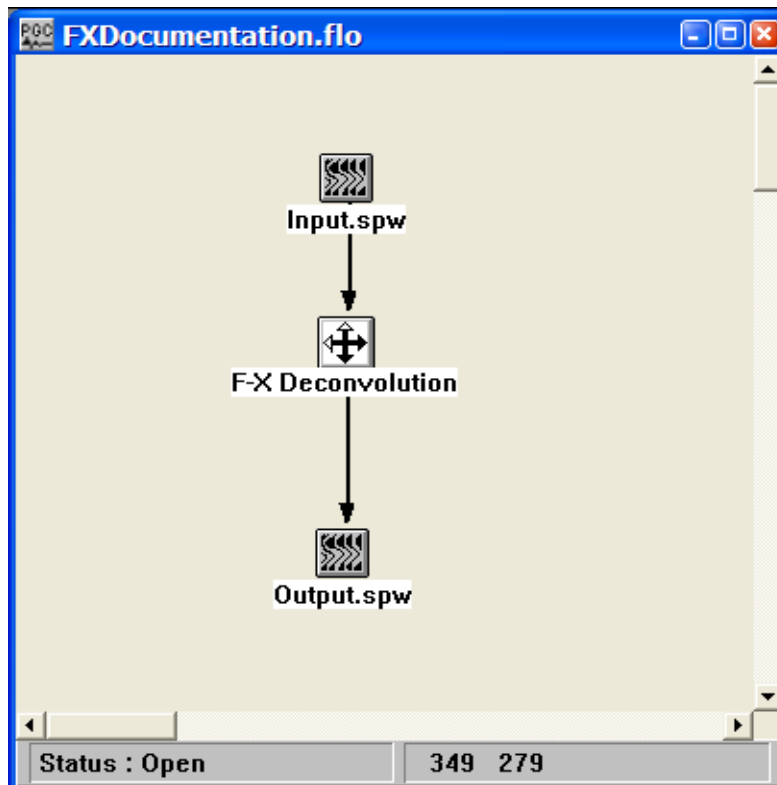
Output Links:

1) Seismic data in any sort order (mandatory).

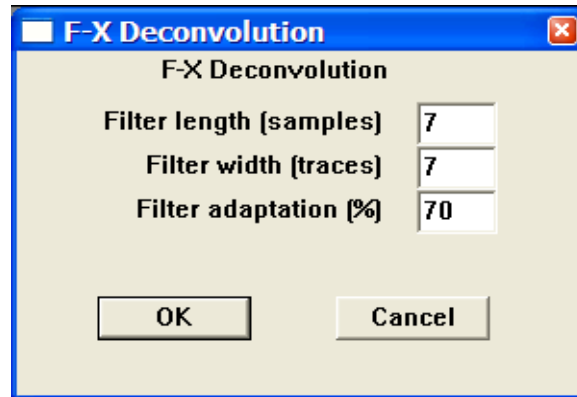
Reference:

Hornbostel, S., 1991, Spatial prediction filtering in the t-x and f-x domain, Geophysics, v. 56, no 12, p. 2019-2026.

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "F-X Deconvolution". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige and contains three labels with corresponding input fields: "Filter length (samples)" with a value of 7, "Filter width (traces)" with a value of 7, and "Filter adaptation (%)" with a value of 70. At the bottom, there are two buttons: "OK" and "Cancel".

F-X Deconvolution	
Filter length (samples)	7
Filter width (traces)	7
Filter adaptation (%)	70
<div>OK Cancel</div>	

Parameter Description:

Filter length in samples — Enter the length of the filter in number of time samples

Filter width in traces — Enter the width of the filter in number of traces.

Filter adaptation percent — Enter the percent adaptation of the filter. Use a smaller percent if filter destroys signal.

F-XY Deconvolution

Usage:

The FXY Deconvolution step is a 3D multi-channel noise filter designed to attenuate random noise. This time-variant, adaptive filter removes the non-predictable part of the data using the assumption that the signal portion of the data is predictable and the noise portion of the data is inherently random, and therefore non-predictable. You specify the length of the filter window, in samples, the inline dimension of the filter window, in traces, the crossline dimension of the filter window, in traces, and the filter adaptation percent. **Note:** the step is currently under construction.

Input Links:

1) Seismic data in any sort order (mandatory).

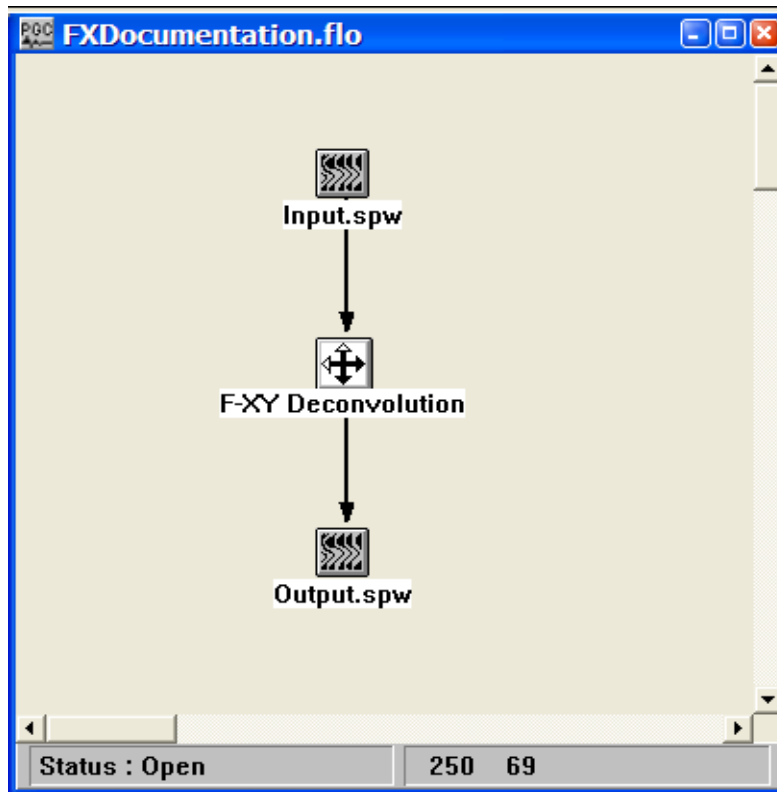
Output Links:

1) Seismic data in any sort order (mandatory).

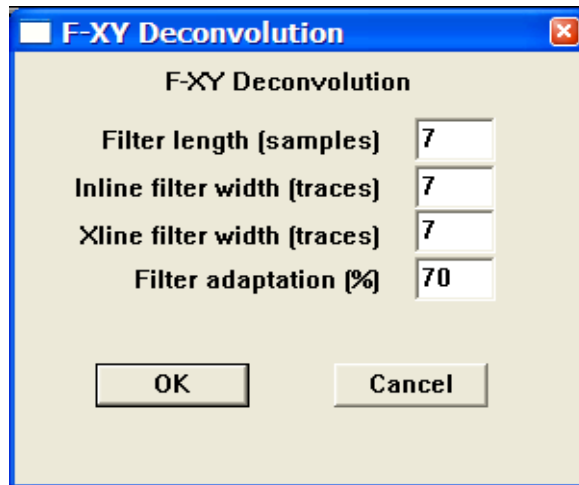
Reference:

Hornbostel, S., 1991, Spatial prediction filtering in the t-x and f-x domain, Geophysics, v. 56, no 12, p. 2019-2026.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "F-XY Deconvolution". It contains four input fields with the following labels and values: "Filter length (samples)" with value 7, "Inline filter width (traces)" with value 7, "Xline filter width (traces)" with value 7, and "Filter adaptation (%)" with value 70. At the bottom are "OK" and "Cancel" buttons.

F-XY Deconvolution	
Filter length (samples)	7
Inline filter width (traces)	7
Xline filter width (traces)	7
Filter adaptation (%)	70
<div>OK Cancel</div>	

Parameter Description:

Filter length in samples — Enter the length of the filter in number of time samples

Inline filter width in traces — Enter the width of the filter in along the inline direction.

Xline filter width in traces — Enter the width of the filter in along the crossline direction.

Filter adaptation percent — Enter the percent adaptation of the filter. Use a smaller percent if filter destroys signal.

Horizontal Median Filter

Usage:

The Horizontal Median step allows you to apply a horizontal median filter across the data traces of a gather or stack. This process is very useful in processing VSP data for separation of up-going and down-going events.

Input Links:

1) Seismic data in any sort order (mandatory).

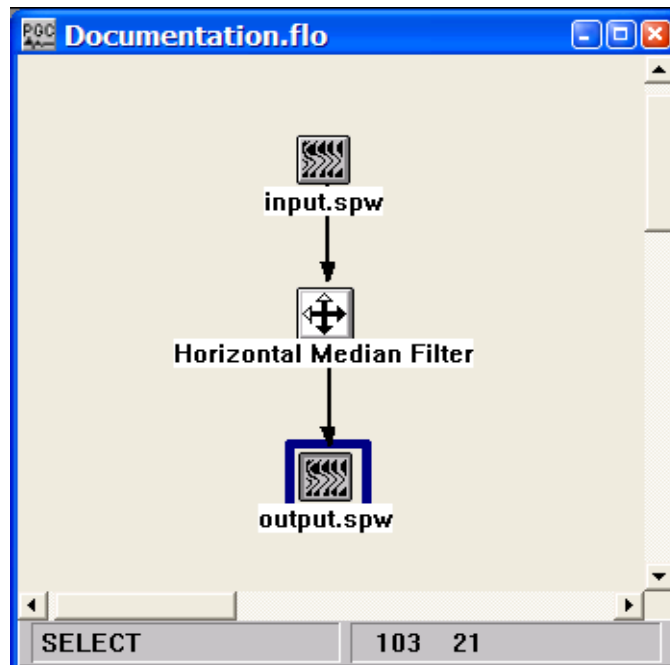
Output Links:

1) Seismic data in any sort order (mandatory).

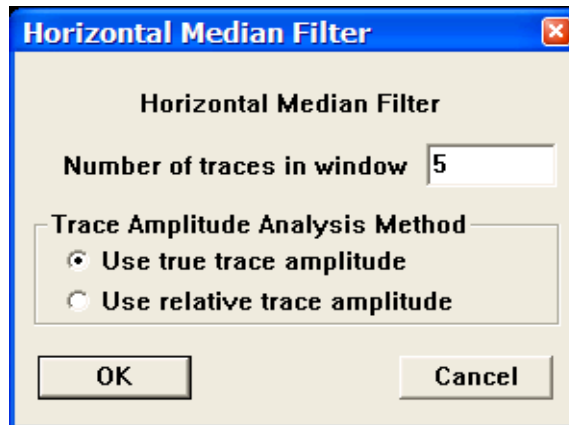
References:

Hardage, B. A., 1983, Vertical Seismic Profiling, Geophysical Press.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Number of traces in window — Enter the number of traces in the spatial window.

Trace Amplitude Analysis Method — Amplitude summing selection.

Use true amplitude traces — True amplitude traces will be used in the median process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — Relative amplitude traces will be used in the median process. Relative amplitude traces are scaled independently of one another.

Integration

Usage:

The Integration step will integrate the data samples in each input seismic data trace.

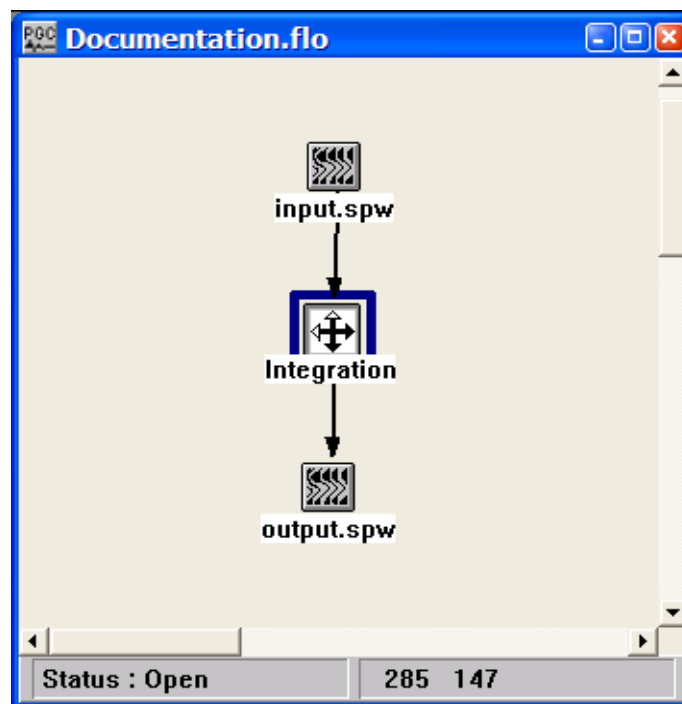
Input Links:

1) Seismic data in any sort order (mandatory).

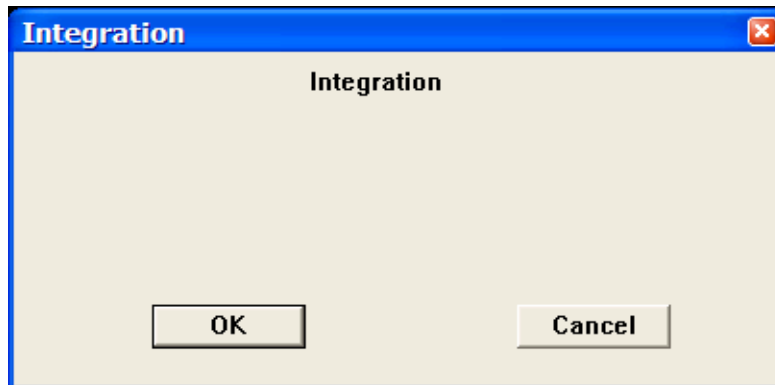
Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Median Filter

Usage:

The Median Filter step is a single channel filter that may be used to remove spikes from your data or any other features such as the wow in radar, which may be filtered by a median operator. You enter the size of the window for calculating the median value.

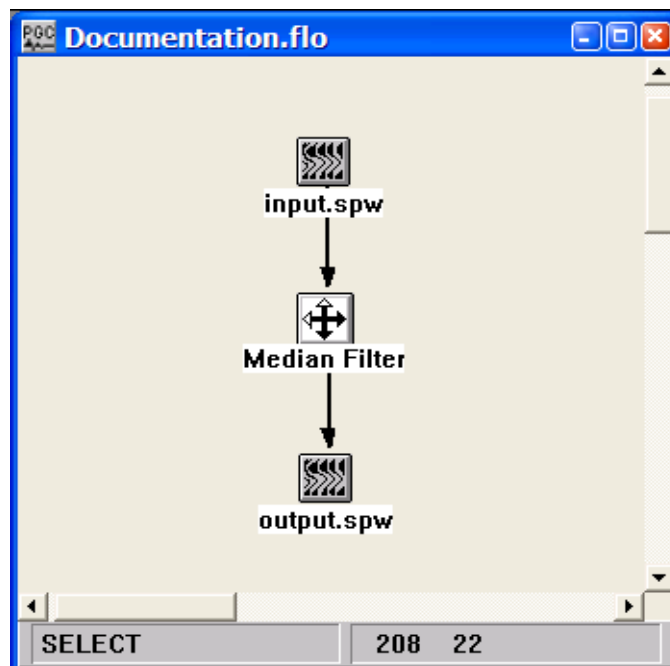
Input Links:

1) Seismic data in any sort order (mandatory).

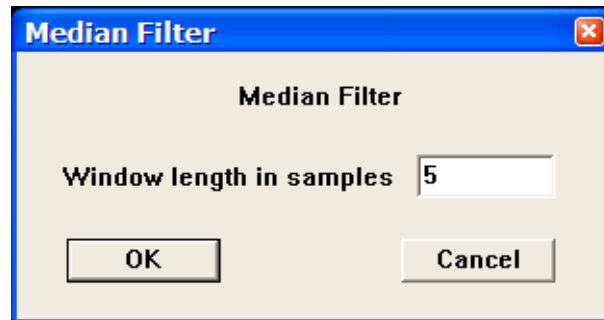
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window length in samples — Enter the number of samples in the window over which the median will be calculated. The sample at the windows center will be replaced by the calculated median value.

Notch Filter

Usage:

The Notch Filter step applies a frequency domain notch filter to the input data. The filter is specified by describing the frequency notch and the width of the notch. Options exist to (1) apply the filter as a function of header word flags, (2) parameterize the notch as a function of header word flags.

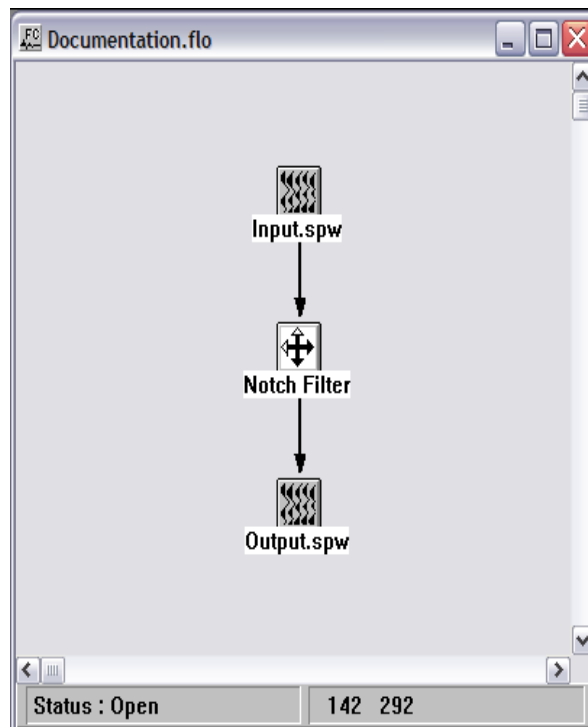
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Notch Filter

Application Window

☐ Apply filter based on a trace header flag

Trace header field: User Def 1

Trace header value: 1

☐ Notch frequency is in a trace header field

Trace header field: User Def 2

Notch frequency (Hz): 50

Notch width (Hz): 4

OK Cancel

Parameter Description:

Application window

Apply filter based on a trace header flag – check this option if the application of the filter is to be controlled by the value of a trace header flag.

Trace header field – If the filter is to be controlled by the value of a trace header flag, select the trace header from the drop down menu.

Trace header value – If the filter is to be controlled by the value of a trace header flag, set the value of the trace header. When the value of the trace header equals the specified value, the filter will be applied. Otherwise, the filter will not be applied.

Notch frequency is in a trace header field – check this option if the value of the notch frequency is to be controlled by the value of a trace header field.

Trace header field – If the notch of the filter is to be controlled by the value of a trace header field, select the trace header from the drop down menu.

Notch frequency (Hz) — Specify the value of the notch frequency in Hertz.

Notch width (Hz) — Specify the width of the notch frequency in Hertz.

Q Filter

Usage:

The Q Filter step applies an attenuation (i.e. “Q”) compensation filter or an attenuation modeling filter to the input file. For both attenuation and modeling options, additional options exist to apply phase only or phase and amplitude filters.

Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

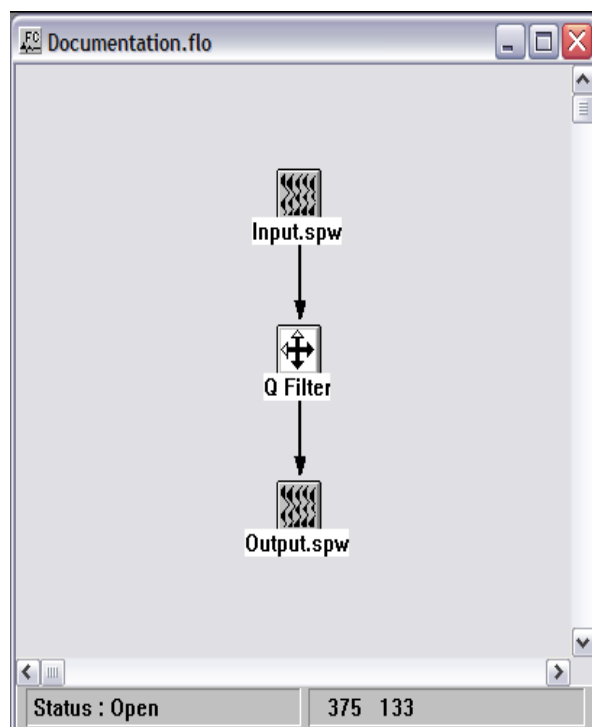
Reference:

Hargreaves, N. D., Calvert A. J., 1991, Inverse Q filtering by Fourier Transform, *Geophysics*, **56**, p. 519.

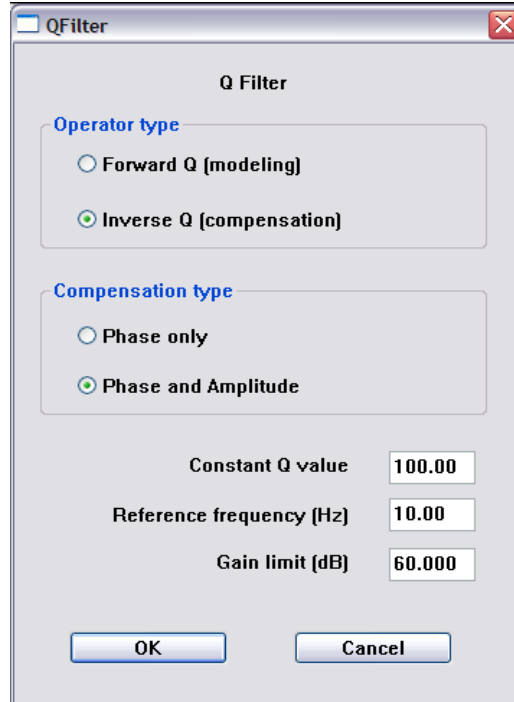
Hargreaves, N., 1992, Similarity and the inverse Q filter: Some simple algorithms for inverse Q filtering, *Geophysics*, **57**, p. 994.

Wang, Y., 2002, A stable and efficient approach of inverse Q filtering, *Geophysics*, **67**, p. 657.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "QFilter". It contains two sections: "Operator type" and "Compensation type". In the "Operator type" section, "Inverse Q [compensation]" is selected with a radio button. In the "Compensation type" section, "Phase and Amplitude" is selected with a radio button. Below these sections are three input fields: "Constant Q value" set to 100.00, "Reference frequency (Hz)" set to 10.00, and "Gain limit (dB)" set to 60.000. At the bottom are "OK" and "Cancel" buttons.

Q Filter	
Operator type	
<input type="radio"/>	Forward Q (modeling)
<input checked="" type="radio"/>	Inverse Q [compensation]
Compensation type	
<input type="radio"/>	Phase only
<input checked="" type="radio"/>	Phase and Amplitude
Constant Q value	100.00
Reference frequency (Hz)	10.00
Gain limit (dB)	60.000
OK Cancel	

Parameter Description:

Operator type

Forward Q (modeling) – Check this option if attenuation is to be introduced to the input seismic traces.

Inverse Q (modeling) – Check this option if attenuation is to be removed from the input seismic traces.

Compensation type

Phase only – Check this option if an allpass, phase-only filter is to be applied for forward or inverse Q filtering. This is the computationally efficient option.

Phase and Amplitude – Check this option if a phase and amplitude type filter is to be applied for forward or inverse Q filtering. This is the computer intensive option.

Constant Q value— Specify the value of Q for forward or inverse Q filtering.

Reference frequency (Hz) — Specify the reference frequency for forward or inverse Q filtering. There will be slight frequency dependent phase shifts with respect to this frequency.

Gain limit (dB) — Specify the maximum gain limit per frequency in the case of inverse Q filtering.

Radon Demultiple

Usage:

The Radon Demultiple step performs parabolic radon demultiple through a modeling of multiples in the parabolic radon domain followed by subtraction of those multiples in the time domain. You specify the transform type, the range of ray parameters in the output transform, and the spatial and temporal taper lengths used to generate the transform.

Input Links:

1) Seismic data in any sort order (mandatory).

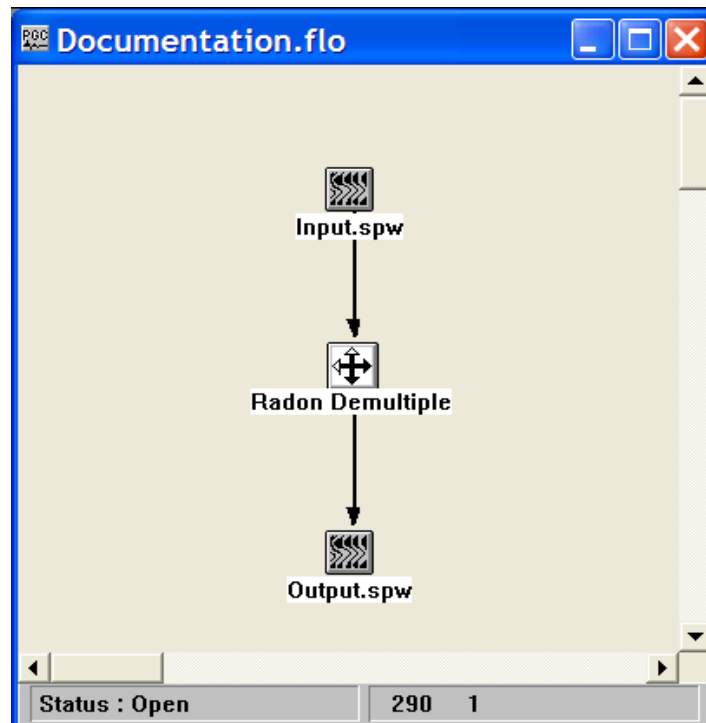
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

Hampson, D., 1991, Inverse velocity stacking for multiple elimination, Journal of the Canadian Society of Exploration Geophysics, **22**, p. 44-55.

Example Flowchart:



Step Parameter Dialog:

Radon Demultiple

Radon Demultiple

Model moveout

Minimum differential moveout -32.0

Maximum differential moveout 500.0

Minimum multiple moveout 100.0

Ray parameters

☐ Set number of ray parameters

Number of ray parameters 200

Percent pre-whitening 20.0

Minimum live traces 5

OK Cancel

Parameter Description:

Model moveout — Set the range of parabolas that will generate the primary and multiple models.

Minimum differential moveout – Set the minimum differential moveout, expressed in milliseconds on the far-offset trace. The primary model is generated with parabolas from the <minimum differential moveout> to the <minimum multiple moveout>.

Maximum differential moveout – Set the maximum differential moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

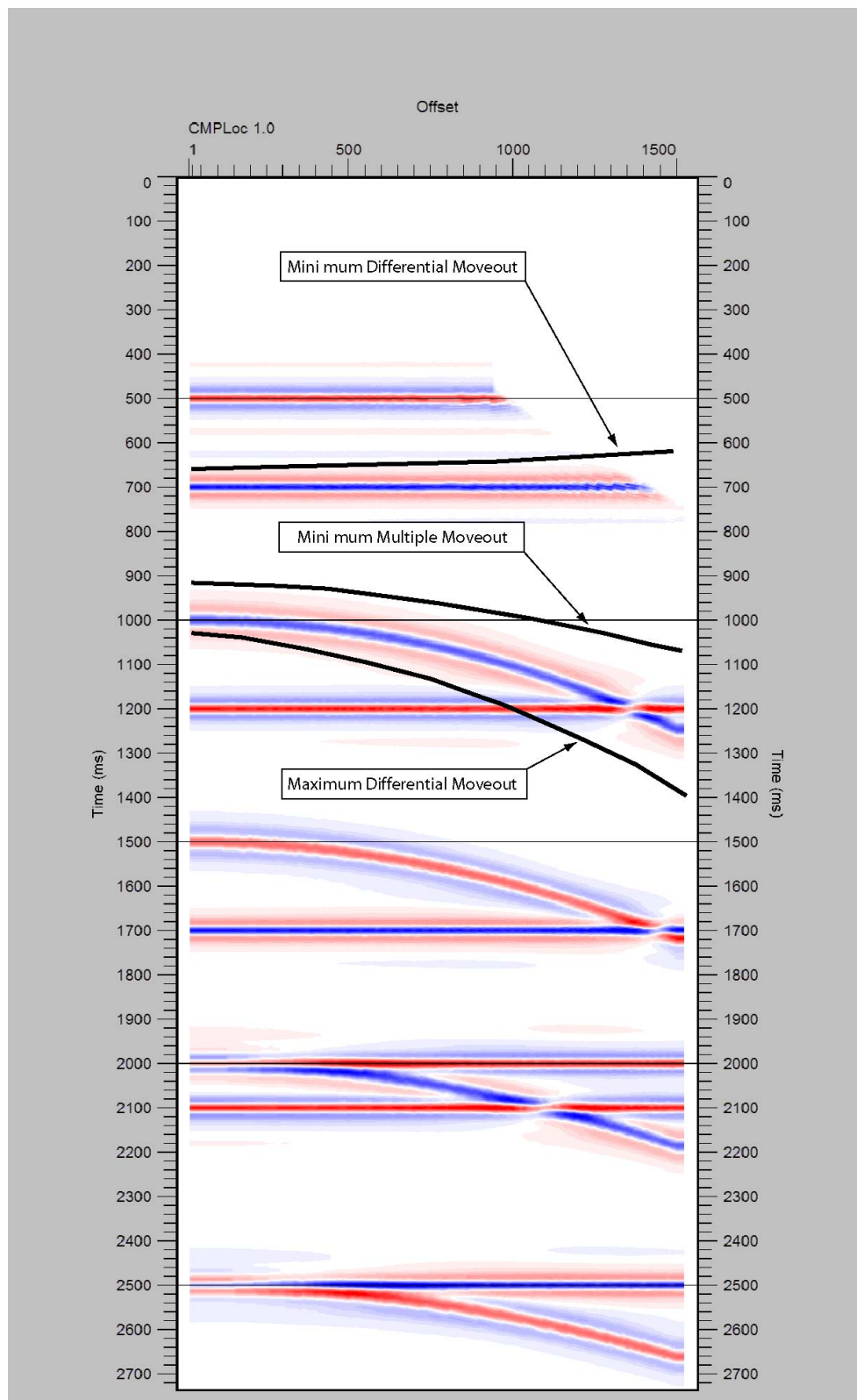
Minimum multiple moveout – Set the minimum multiple moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Set number of ray parameters — If checked, the number of ray parameters is determined manually. By default, the number of ray parameters is determined internally.

Number of ray parameters – set the number of ray parameter.

Percent pre-whitening – Enter the amount of pre-whitening used to stabilize the least-squares inversion in the presence of noise.

Minimum live traces – Enter the minimum number of live traces that must be present in a gather in order to transform that gather.



Radon Transform

Usage:

The classical Radon transform consists of a straight-line summation over a range of ray parameters at each intercept value. The generalized Radon transform allows for summation along curved surfaces, which for geophysical applications may also be parabolic and hyperbolic functions of offset. The Radon Transform step can be used to compute the linear, parabolic, or hyperbolic Radon transform from the space-time domain to the domain of linear, parabolic, or hyperbolic ray parameter and intercept. You specify the transform type, the range of ray parameters in the output transform, and the spatial and temporal taper lengths used to generate the transform.

Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

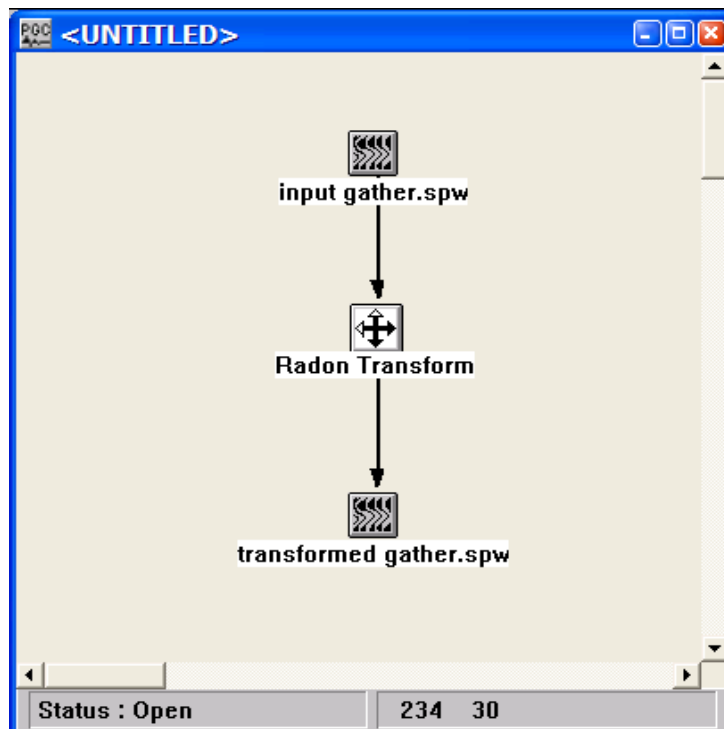
Reference:

Thorston, J. R. and Claerbout, J. F., 1985, Velocity-stack and slant-stack stochastic inversion, *Geophysics*, **50**, p. 2727-2741.

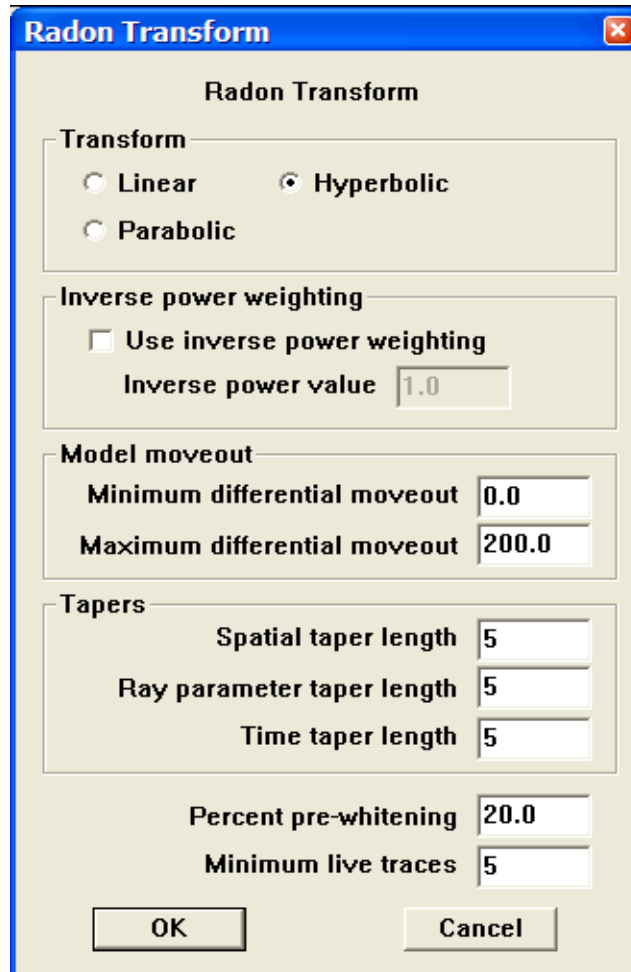
Hampson, D., 1991, Inverse velocity stacking for multiple elimination, *Journal of the Canadian Society of Exploration Geophysics*, **22**, p. 44-55.

Example

Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Radon Transform". It contains several sections for configuring the transform. The "Transform" section has three radio buttons: "Linear", "Hyperbolic" (which is selected), and "Parabolic". The "Inverse power weighting" section has a checkbox labeled "Use inverse power weighting" which is unchecked, and a text box for "Inverse power value" containing "1.0". The "Model moveout" section has two text boxes: "Minimum differential moveout" with "0.0" and "Maximum differential moveout" with "200.0". The "Tapers" section has three text boxes: "Spatial taper length" with "5", "Ray parameter taper length" with "5", and "Time taper length" with "5". At the bottom, there are two text boxes: "Percent pre-whitening" with "20.0" and "Minimum live traces" with "5". "OK" and "Cancel" buttons are at the bottom center.

Radon Transform		
Transform		
<input type="radio"/> Linear	<input checked="" type="radio"/> Hyperbolic	
<input type="radio"/> Parabolic		
Inverse power weighting		
<input type="checkbox"/> Use inverse power weighting		
Inverse power value	1.0	
Model moveout		
Minimum differential moveout	0.0	
Maximum differential moveout	200.0	
Tapers		
Spatial taper length	5	
Ray parameter taper length	5	
Time taper length	5	
Percent pre-whitening		20.0
Minimum live traces		5
OK		Cancel

Parameter Description:

Transform — Select the type of Radon transform to perform.

Linear – If selected, a transform will be performed from the domain of space and time to the domain of ray parameter and intercept.

Parabolic – If selected, a transform will be performed from the domain of space and time to the domain of parabolic ray parameter and intercept.

Hyperbolic – If selected, a transform will be performed from the domain of space and time to the domain of hyperbolic ray parameter and intercept.

Inverse power weighting — If checked, a weighting scheme is applied to the input data prior to computing the transform. Not Recommended.

Model moveout — Set the range of ray parameters for the transformed output.

Minimum differential moveout – minimum far-offset moveout value present in the transformed data.

Maximum differential moveout – maximum far-offset moveout value present in the transformed data.

Tapers — Set the spatial and temporal taper lengths used in constructing the transform.

Spatial taper length – Number of traces to taper at the near and far offsets of the X-T gather prior to computing the transform.

Ray parameter taper length – Ray taper.

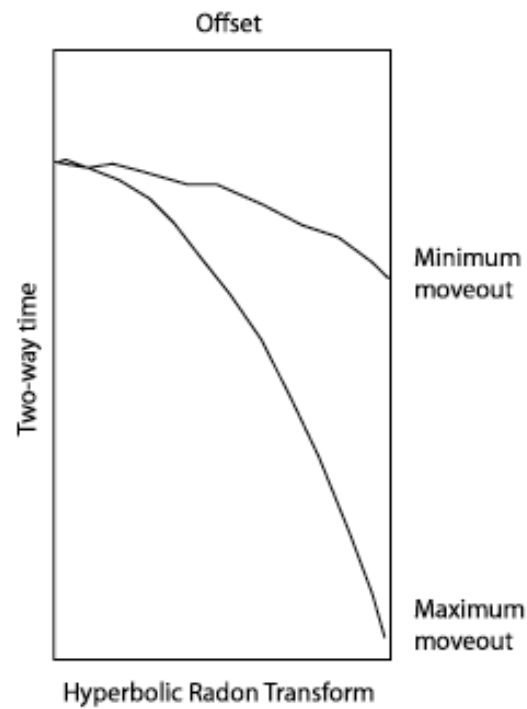
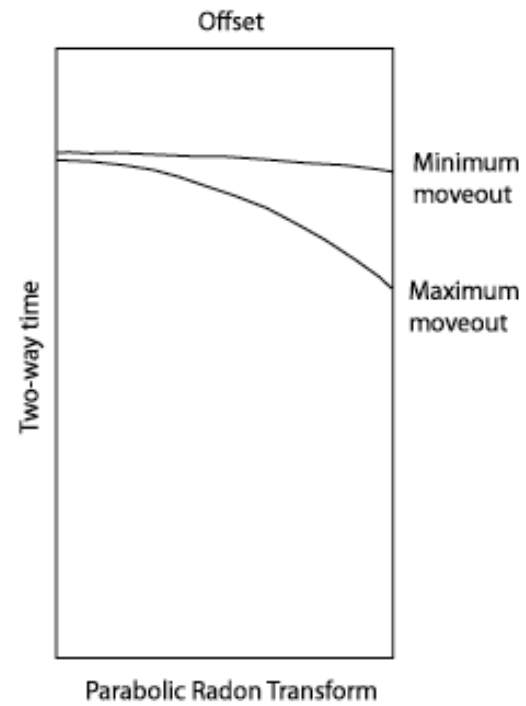
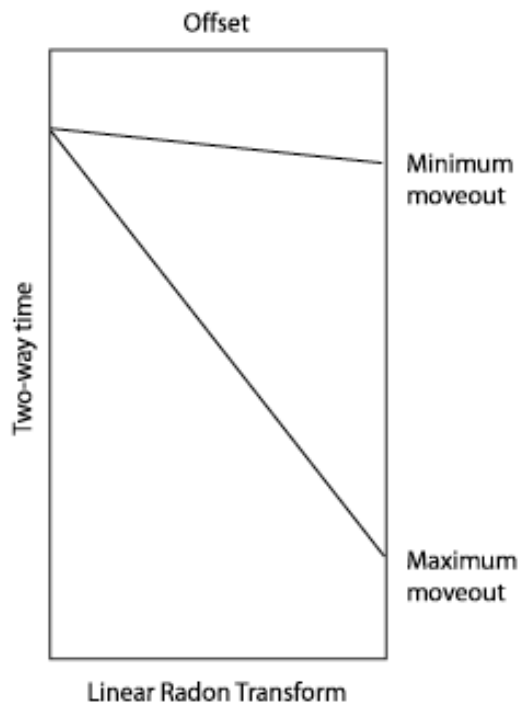
Time taper length – Length of taper to apply at the start and end of the X-T gather prior to computing the transform.

Percent pre-whitening – Enter the amount of pre-whitening used to stabilize the least-squares inversion in the presence of noise.

.

Minimum live traces – Enter the minimum number of live traces that must be present in a gather in order to transform that gather.

Transform Types



Radon Inverse

Usage:

The Radon Inverse step transforms data from the linear, parabolic, or hyperbolic Radon transform domain to the space-time domain. You specify the transform type and the range and number of transformed output traces.

Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

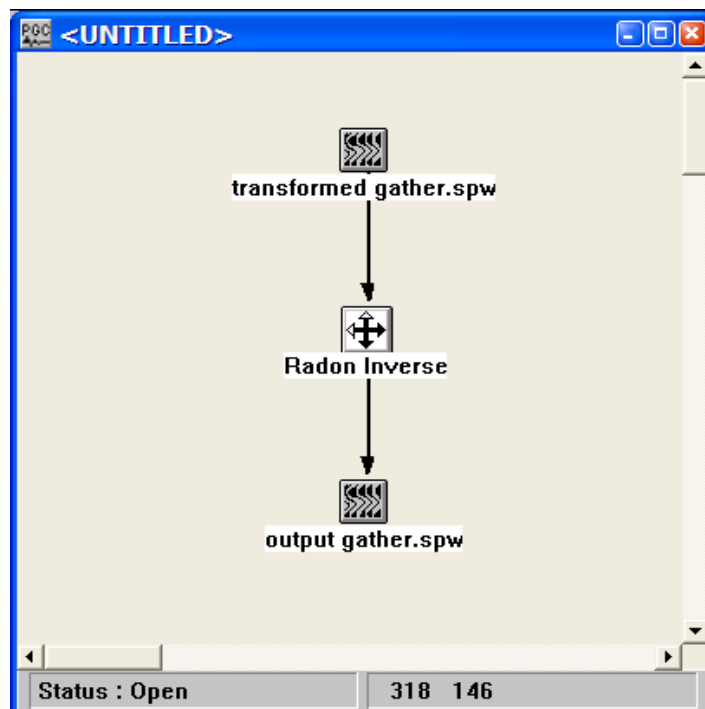
1) Seismic data in any sort order (mandatory).

Reference:

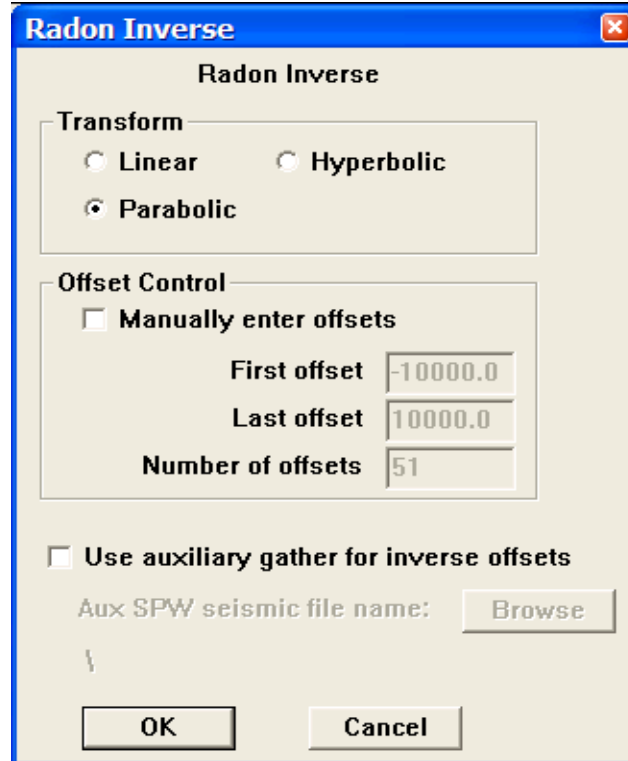
Thorston, J. R. and Claerbout, J. F., 1985, Velocity-stack and slant-stack stochastic inversion, *Geophysics*, **50**, p. 2727-2741.

Hampson, D., 1991, Inverse velocity stacking for multiple elimination, *Journal of the Canadian Society of Exploration Geophysics*, **22**, p. 44-55.

Example Flowchart



Step Parameter Dialog:



The image shows a software dialog box titled "Radon Inverse". It contains three main sections. The first section, "Transform", has three radio buttons: "Linear", "Hyperbolic", and "Parabolic", with "Parabolic" selected. The second section, "Offset Control", has a checkbox "Manually enter offsets" which is checked. Below this are three input fields: "First offset" with the value "-10000.0", "Last offset" with the value "10000.0", and "Number of offsets" with the value "51". The third section has a checkbox "Use auxiliary gather for inverse offsets" which is unchecked, followed by a label "Aux SPW seismic file name:" and a "Browse" button. At the bottom are "OK" and "Cancel" buttons.

Parameter Description:

Transform — Select the type of Radon transform to perform.

Linear – If selected, a transform will be performed from the domain of space and time to the domain of ray parameter and intercept.

Parabolic – If selected, a transform will be performed from the domain of space and time to the domain of parabolic ray parameter and intercept.

Hyperbolic – If selected, a transform will be performed from the domain of space and time to the domain of hyperbolic ray parameter and intercept.

Offset control — Allows manual control of the output offsets.

Manually enter offsets — If checked, indicates that the offsets in the output gathers will be entered manually

First offset – enter the smallest offset to be present in the output gather.

Last offset – enter the largest offset to be present in the output gather.

Number of offsets – enter the number of offsets to be present in the output gather.

User auxiliary gather for inverse offsets — If checked, the offsets in the output gathers will be taken from those of an auxiliary data file (e.g. the input to the forward transform).

Browse – select the data file that will provide the offset header information.

Ricker Filter

Usage:

The Ricker Filter step applies a ricker filter to the input seismic file. The Ricker filter is completely determined by the center frequency of the Ricker wavelet.

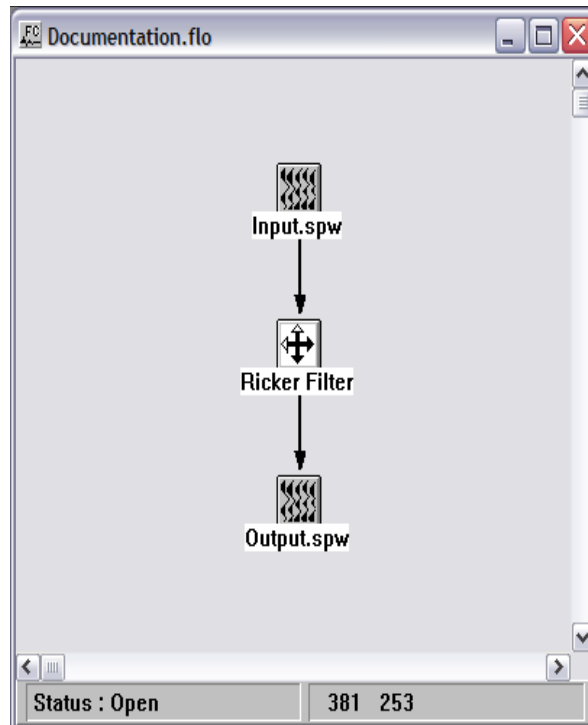
Input Links:

1) Seismic data in any sort order (mandatory).

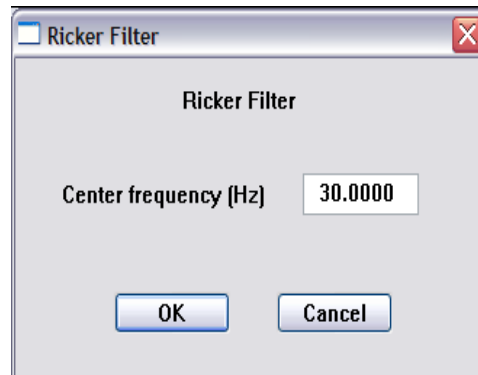
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Center frequency (Hz) — Specify the center frequency of the Ricker wavelet.

Spatial Noise Filter

Usage:

The spatial noise filter step is a random noise reduction technique for removing or suppressing random noise in your data. This time-variant, adaptive filter removes the non-predictable part of the data using the assumption that the signal portion of the data is predictable and the noise portion of the data is inherently random, and therefore non-predictable. You specify the length of the filter window, in samples, the width of the filter window, in traces, and the filter adaptation percent. You may choose to apply the filter a bottom up (i.e. bottom to top) direction or a top down (i.e. top to bottom) direction.

Input Links:

1) Seismic data in any sort order (mandatory).

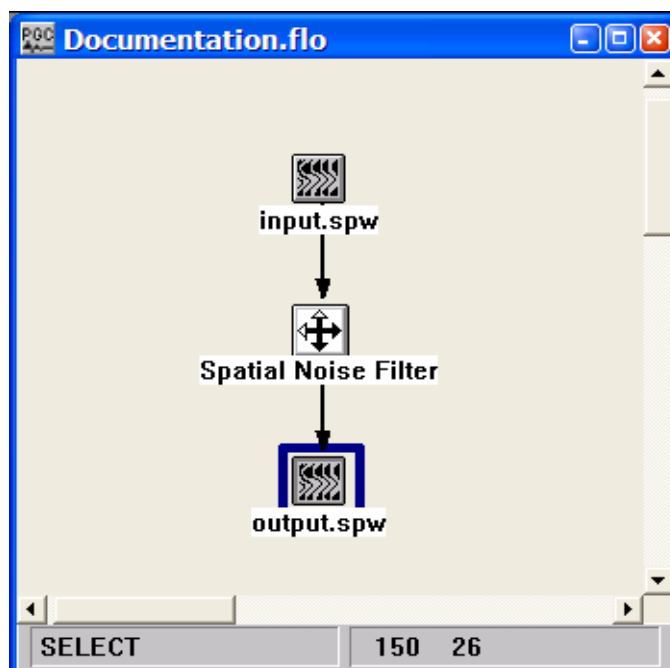
Output Links:

1) Seismic data in any sort order (mandatory).

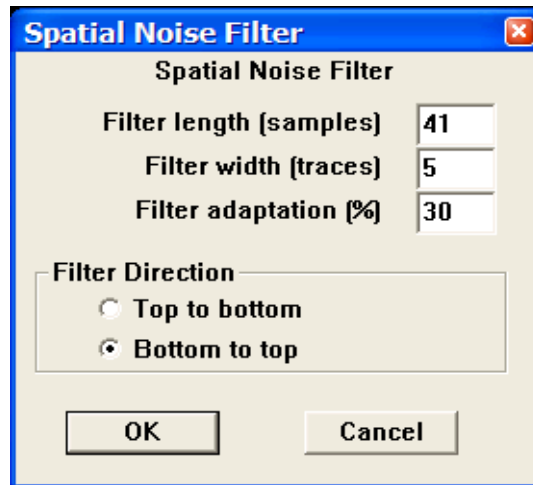
Reference:

Hornbostel, S., 1991, Spatial prediction filtering in the t-x and f-x domain, Geophysics, v. 56, no 12, p. 2019-2026.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Filter length in samples — Enter the length of the filter in number of time samples

Filter width in traces — Enter the width of the filter in number of traces.

Filter adaptation percent — Enter the percent adaptation of the filter. Use a smaller percent if filter blows up data.

Filter Direction — Select the direction to apply the filter. Since this is an adaptive filter, bottom to top filters often give better results.

Top to bottom — This selection applies the filter from the top of the trace to the bottom. If selected, the filter will be applied starting from the top left corner of your data and continuing downward. When the end of this column of your data is reached, the filter shifts to the right by the specified number of traces (i.e. filter width) and starts down the next column of your data from the top.

Bottom to top — This selection applies the filter from the bottom of the trace to the top. If selected, the filter will be applied starting from the bottom left corner of your data and continue upward. When the end of this column of your data is reached, the filter shifts to the right by the specified number of traces (i.e. filter width) and starts up the next column of your data from the bottom.

Swell Removal

Usage:

The Swell Removal step allows you to remove short period static shifts caused by the ocean swell. The statics are picked using correlation over the trace and then smoothed using a multi-trace smoother.

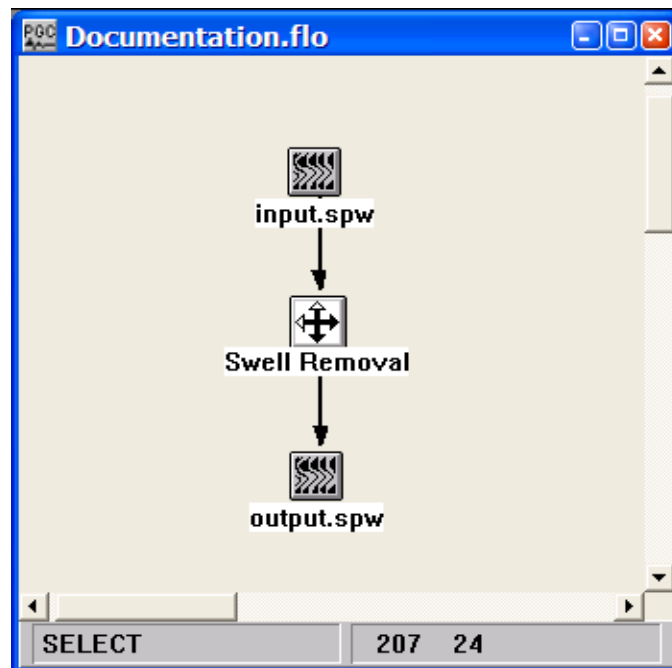
Input Links:

1) Seismic data in any sort order (mandatory).

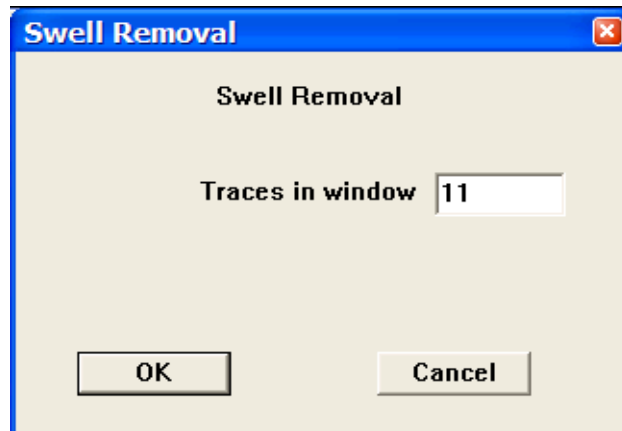
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Traces in window — Enter the number of traces in each analysis window.

Time Variant Bandpass

Usage:

The Time Variant Bandpass step allows you to apply up to five (5) different time-variant bandpass filters to your trace data. You specify the low cut, low pass, high pass and high cut, filter points for each filter and the starting time for application of the filter. You also specify the filter taper length, which allows you to control the smoothness of the transition between adjacent filters.

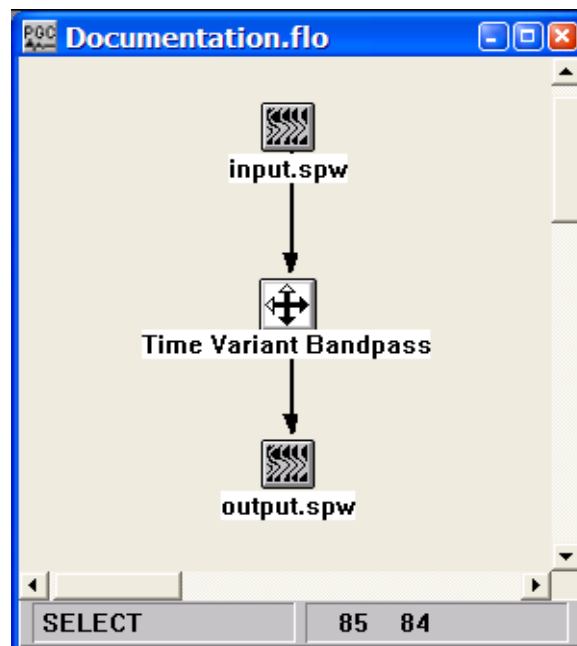
Input Links:

1) Seismic data in any sort order (mandatory).

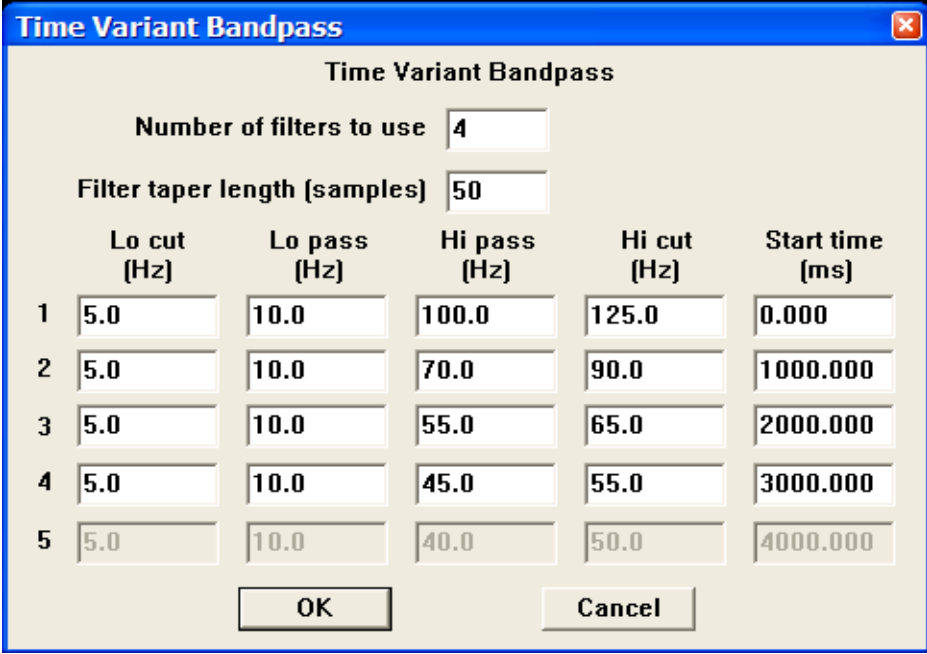
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Time Variant Bandpass" and contains the following controls:

- Number of filters to use:** A text box containing the value "4".
- Filter taper length (samples):** A text box containing the value "50".
- Filter parameters table:** A table with 5 rows and 5 columns. The columns are labeled "Lo cut (Hz)", "Lo pass (Hz)", "Hi pass (Hz)", "Hi cut (Hz)", and "Start time (ms)". The rows are numbered 1 through 5.

	Lo cut (Hz)	Lo pass (Hz)	Hi pass (Hz)	Hi cut (Hz)	Start time (ms)
1	5.0	10.0	100.0	125.0	0.000
2	5.0	10.0	70.0	90.0	1000.000
3	5.0	10.0	55.0	65.0	2000.000
4	5.0	10.0	45.0	55.0	3000.000
5	5.0	10.0	40.0	50.0	4000.000

At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Number of filters to use — Enter the number of filters to apply.

Filter taper length — Enter the length of the filter taper in samples. The longer the filters taper length, the smoother the transition between adjacent filters.

Low cut — Enter the low cut frequency of the bandpass filter in Hertz.

Low pass — Enter the low pass frequency of the bandpass filter in Hertz.

High pass — Enter the high pass frequency of the bandpass filter in Hertz.

High cut — Enter the high cut frequency of the bandpass filter in Hertz.

Start time (ms) — Enter the start time in milliseconds to start the application of each filter.

Time Variant Butterworth

Usage:

The Time Variant Butterworth step allows you to apply up to five (5) different time-variant Butterworth filters to your trace data. You specify the low pass, high pass and low and high rolloff rates in decibels (dB) for each filter, as well as the starting time for application of the filter. You also specify the filter taper length, which controls the smoothness of the transition between adjacent filters.

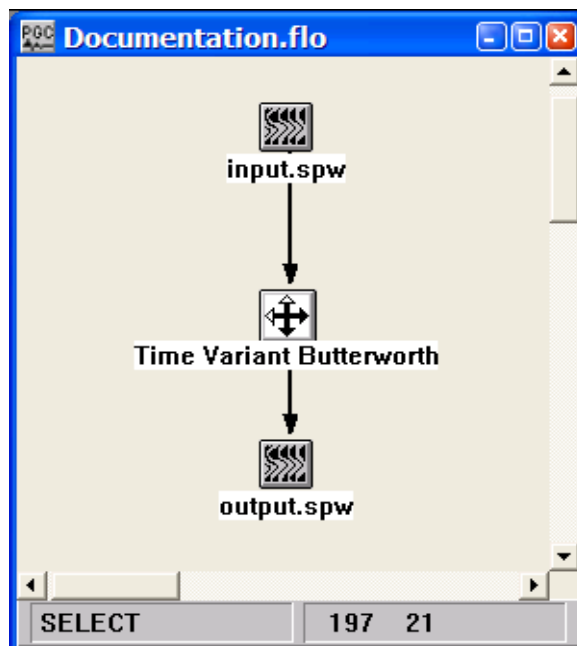
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

	Lo pass (Hz)	Hi pass (Hz)	Lo rolloff (dB/oct)	Hi rolloff (dB/oct)	Start time (ms)
1	10.0	100.0	18.0	18.0	0.000
2	10.0	70.0	18.0	18.0	1000.000
3	10.0	55.0	18.0	18.0	2000.000
4	10.0	45.0	18.0	18.0	3000.000
5	10.0	40.0	18.0	18.0	4000.000

Parameter Description:

Number of filters to use — Enter the number of filters to apply.

Filter taper length— Enter the length of the filter taper in samples. The longer the filters taper length, the smoother the transition between adjacent filters.

Low frequency — Enter the low pass frequency of the Butterworth filter in Hertz.

Low rolloff rate — Enter the low pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

High frequency — Enter the high pass frequency of the Butterworth filter in Hertz.

High rolloff rate — Enter the high pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

Time (ms) — (Start) — Enter the start time in milliseconds to the start application of each filter.

Wave Equation Multiple Attenuation

Usage:

The Wave Equation Multiple Attenuation step predicts water-bottom and peg-leg multiples by extrapolating the observed seismic data through one round trip of the water column. The predicted multiples are then subtracted from the observed data to achieve multiple suppression. **Note:** the step is currently under construction.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Horizon pick card containing water bottom pick times (mandatory).

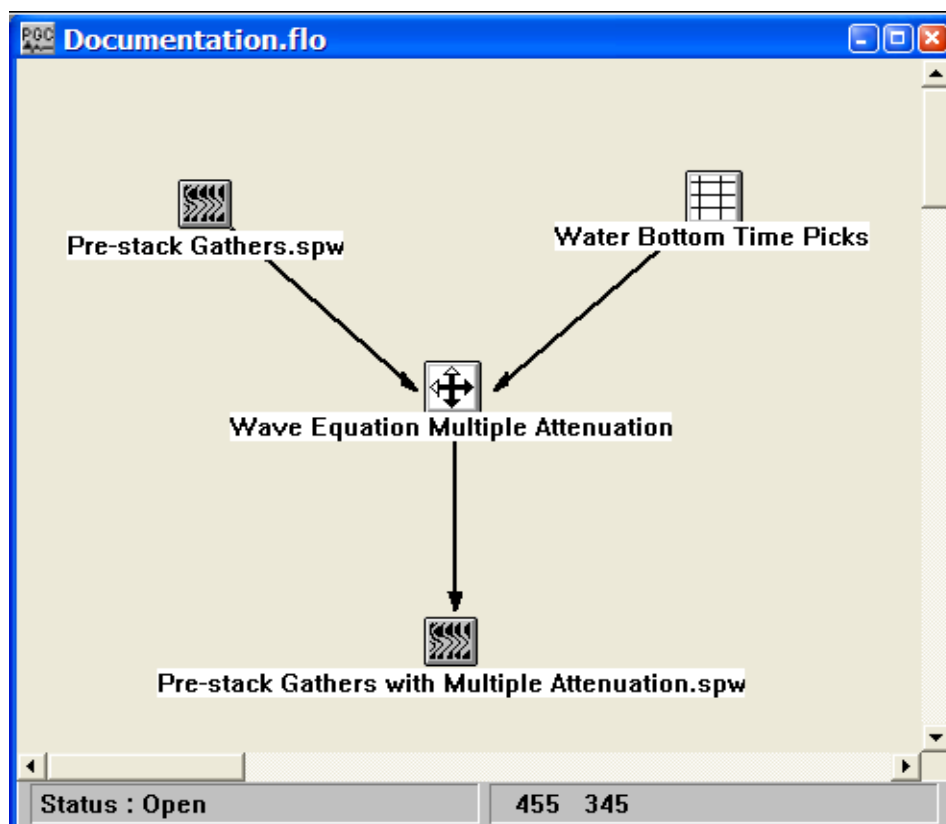
Output Links:

- 1) Seismic data in any sort order (mandatory).

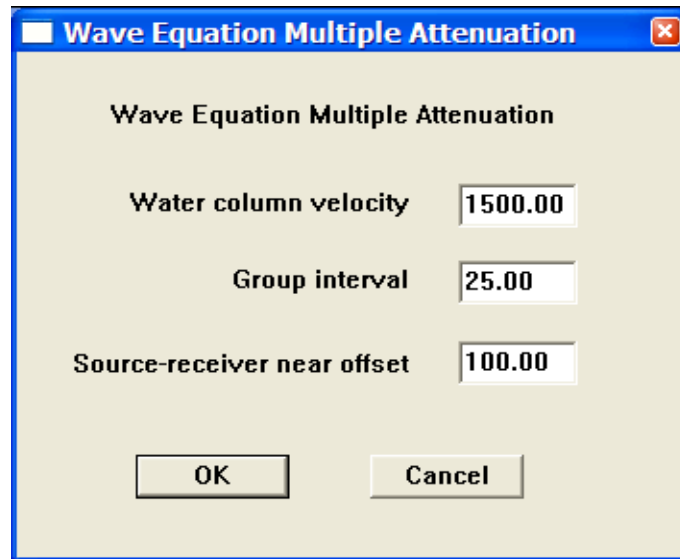
Reference:

Berryhill, J. R, and Kim, Y. C., 1986, Deep-water peg legs and multiples: Emulation and suppression, *Geophysics*, v. 51, no 12, p. 2177-2184.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Wave Equation Multiple Attenuation". It has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. At the top, the title "Wave Equation Multiple Attenuation" is repeated. Below this, there are three parameter labels on the left and their corresponding numerical values in text boxes on the right: "Water column velocity" with the value "1500.00", "Group interval" with the value "25.00", and "Source-receiver near offset" with the value "100.00". At the bottom of the dialog, there are two buttons: "OK" and "Cancel".

Parameter	Value
Water column velocity	1500.00
Group interval	25.00
Source-receiver near offset	100.00

Parameter Description:

Water column velocity — Enter the velocity of propagation in the water column.

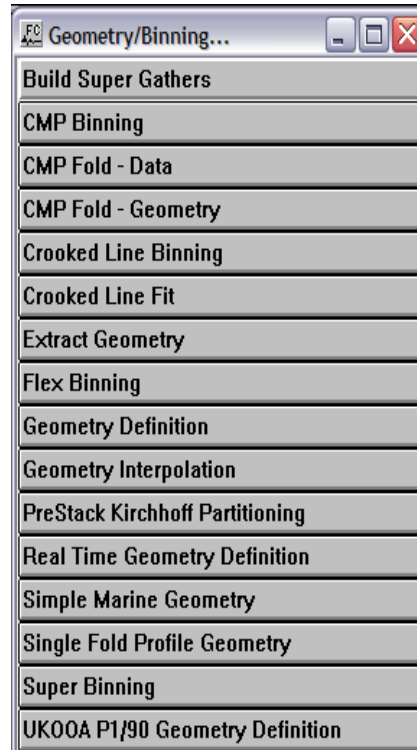
Group interval — Enter the acquisition group interval.

Source-receiver near offset — Enter the offset from the source to the nearest receiver in the spread.

Geometry/Binning Steps

This section documents the processing steps available in the Geometry/Binning category.

Processing steps currently available are:



Note Trace Header Geometry Application

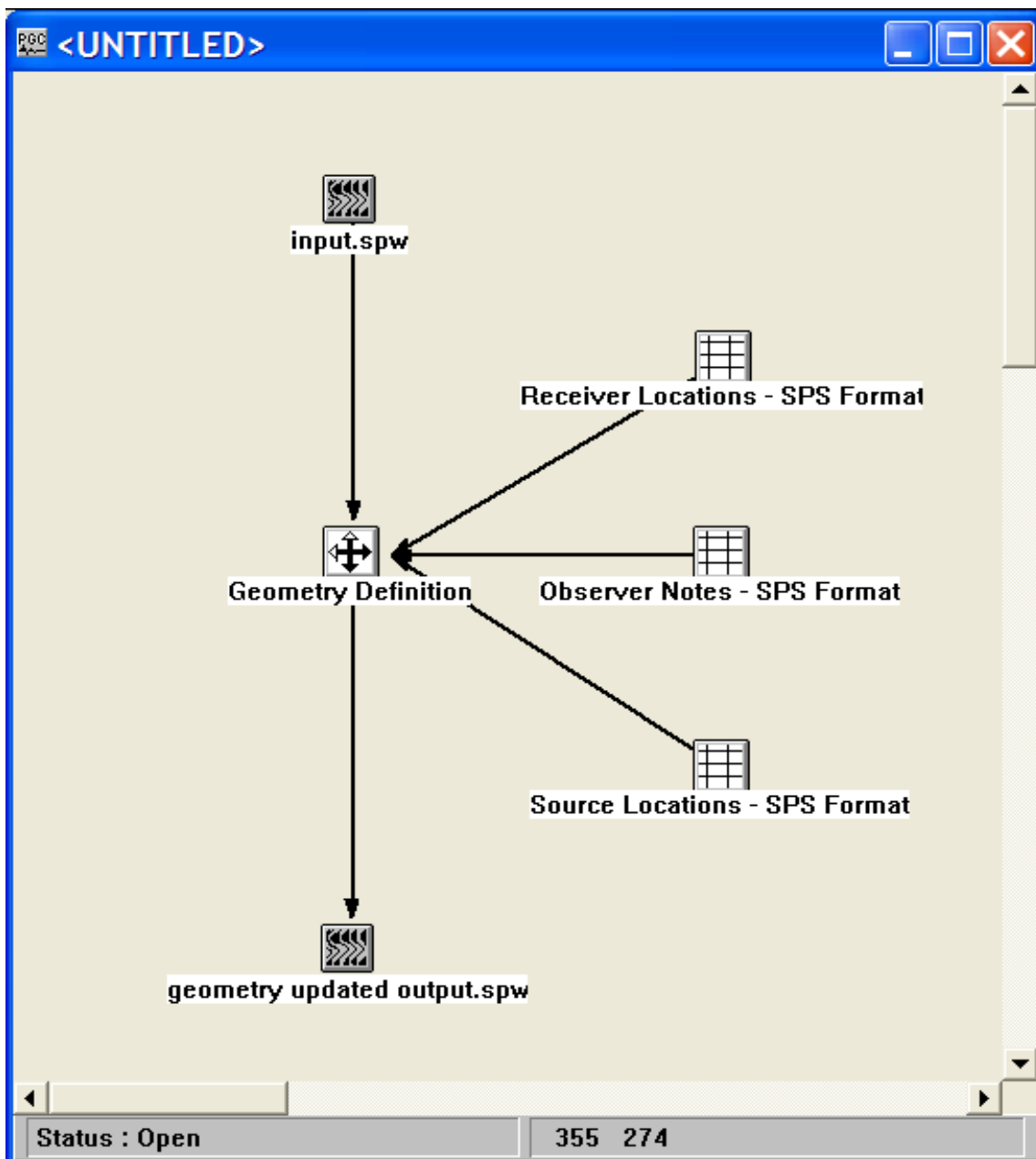
The first step in the majority of processing sequences is to update the seismic field headers with the acquisition geometry information. This information is required to perform basic data analysis and to execute almost all multi-channel processing steps.

There are three basic structures for the processing flow that is used to update the seismic trace header with the acquisition geometry information. The structure you use will depend on the nature of the seismic survey. The three seismic surveys and their associated processing flows can be classified as follows;

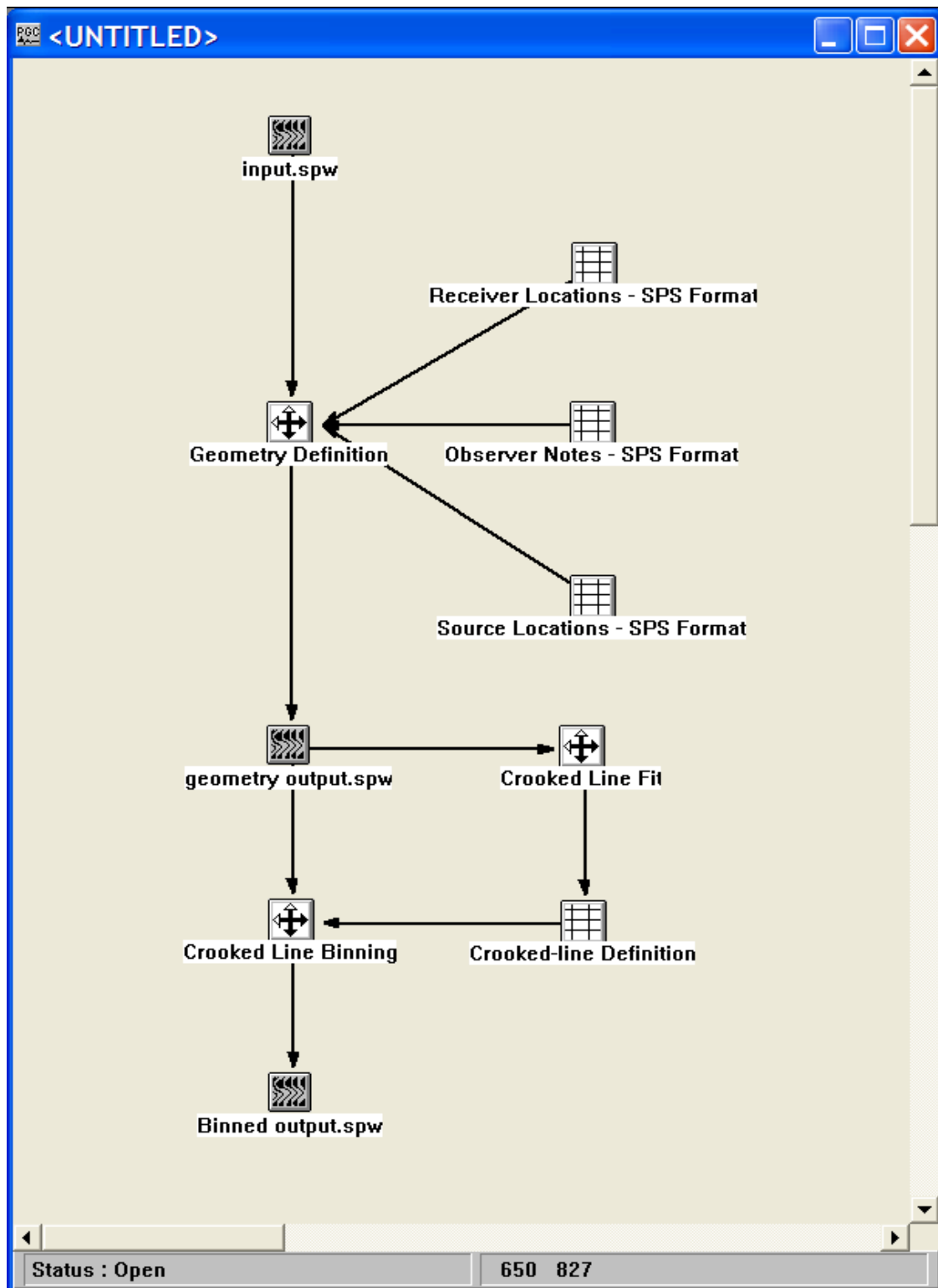
- (1) 2D seismic. In SPW, 2D seismic surveys are those in which the sources and receivers are laid out on the same 2D line and the CMP number can be computed as $CMP = (Source\ Location + Receiver\ Location) / 2$. This implies that source location 101 and receiver location 101 are co-located (i.e. have the same X,Y coordinates).
- (2) Crooked line 2D seismic. In SPW, Crooked line 2D seismic surveys are those that will be processed as a single CMP line, though the sources and receivers are not necessarily laid out along the same line. This implies that source location 101 and receiver location 101 need not be co-located (i.e. are not required to have the same X,Y coordinates).
- (3) 3D seismic. In SPW, 3D seismic surveys are those in which the sources and receivers are laid out areally and the data will be organized in terms of inlines and crosslines.

An example of each of these three types of processing flows can be found in the Templates library under the Geometry category.

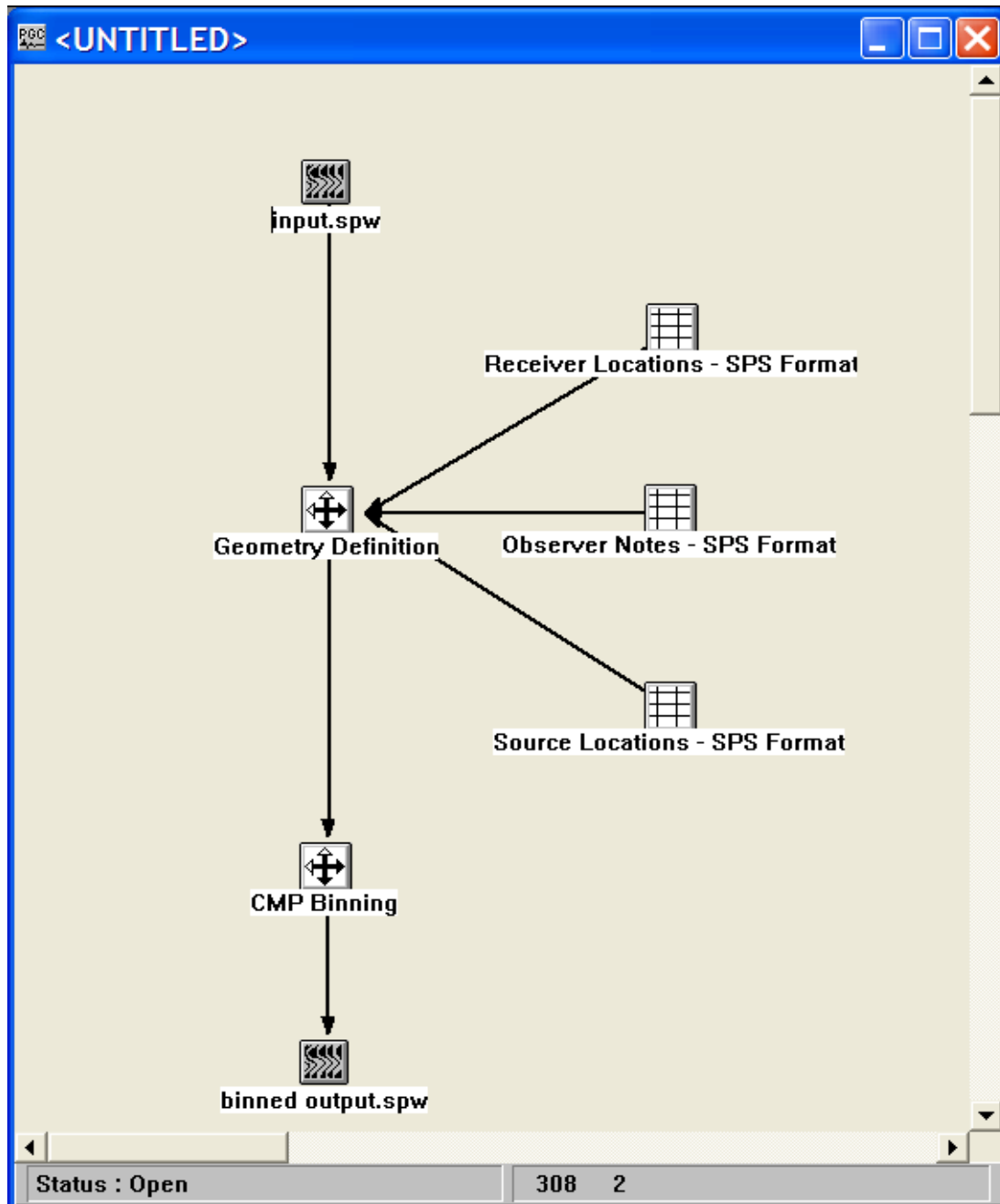
Example Flowchart for a 2D seismic survey:



Example Flowchart for a crooked line 2D seismic survey:



Example Flowchart for a 3D seismic survey:



Build Supergathers

Usage:

The Build Supergathers step outputs patches of pre-stack CMP data defined on an inline and crossline grid. The output of the Build Supergathers step is designed to be input to the Super Gather Velocity Analysis step located in the Velocities category. Together, the two steps allow for improved velocity analysis by increasing the fold of coverage at the velocity analysis location. The user defines the patch size and the patch interval in units of inlines and crosslines.

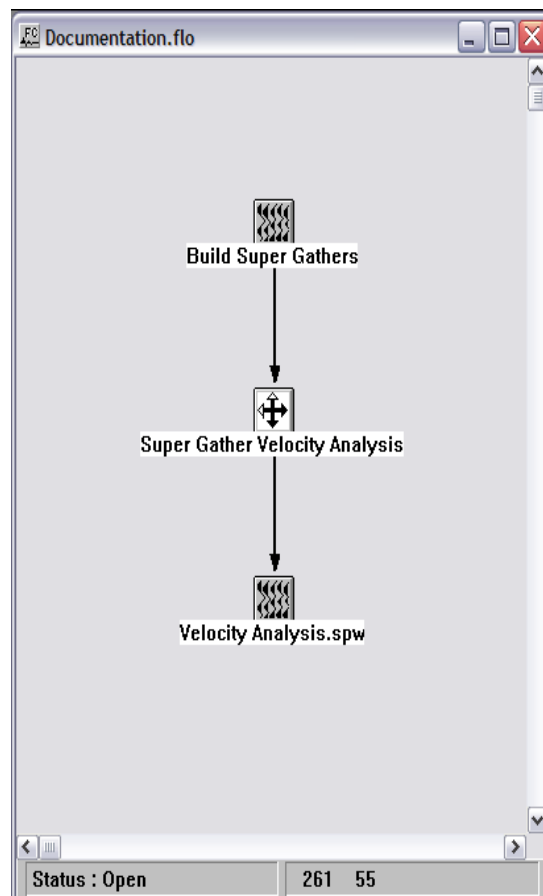
Input Links:

1) Seismic data in any sort order (mandatory).

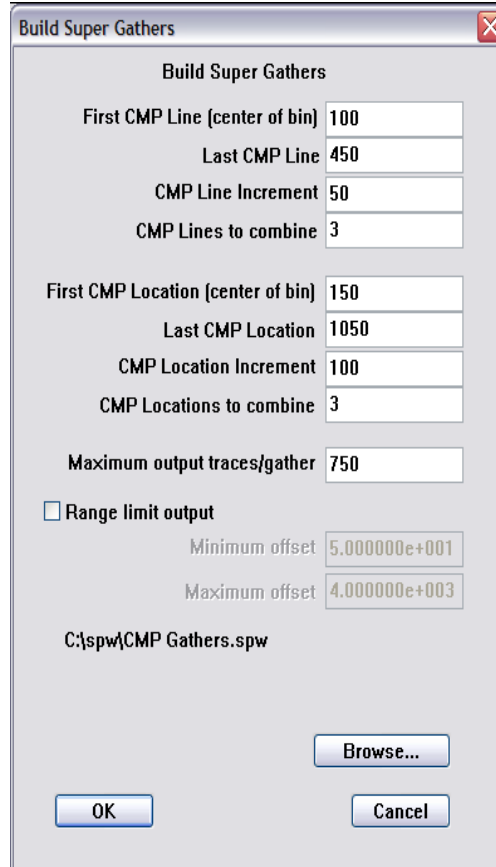
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Build Super Gathers" and contains the following parameters:

Parameter	Value
First CMP Line (center of bin)	100
Last CMP Line	450
CMP Line Increment	50
CMP Lines to combine	3
First CMP Location (center of bin)	150
Last CMP Location	1050
CMP Location Increment	100
CMP Locations to combine	3
Maximum output traces/gather	750
Range limit output	<input type="checkbox"/>
Minimum offset	5.000000e+001
Maximum offset	4.000000e+003
File path	C:\spw\CMP Gathers.spw

Buttons: OK, Cancel, Browse...

Parameter Description:

First CMP Line (center of bin) — First line to output binned gathers.

Last CMP Line — Last line to output binned gathers.

CMP Line Increment — Line increment for outputting binned gathers.

CMP Lines to combine — Number of lines to combine in a bin.

First CMP Location (center of bin) — First location to output binned gathers.

Last CMP Location — Last location to output binned gathers.

CMP Location Increment — Location increment for outputting binned gathers.

CMP Location to combine — Number of locations to combine in a bin.

Maximum output traces per gather — Maximum fold of the binned gathers.

Range limit output — Check this box if you wish to limit the offset range of the output binned gathers.

Minimum offset – enter minimum offset of the range-limited supergathers.

Maximum offset – enter maximum offset of the range-limited supergathers.

Browse – Use the browse button to select the input file.

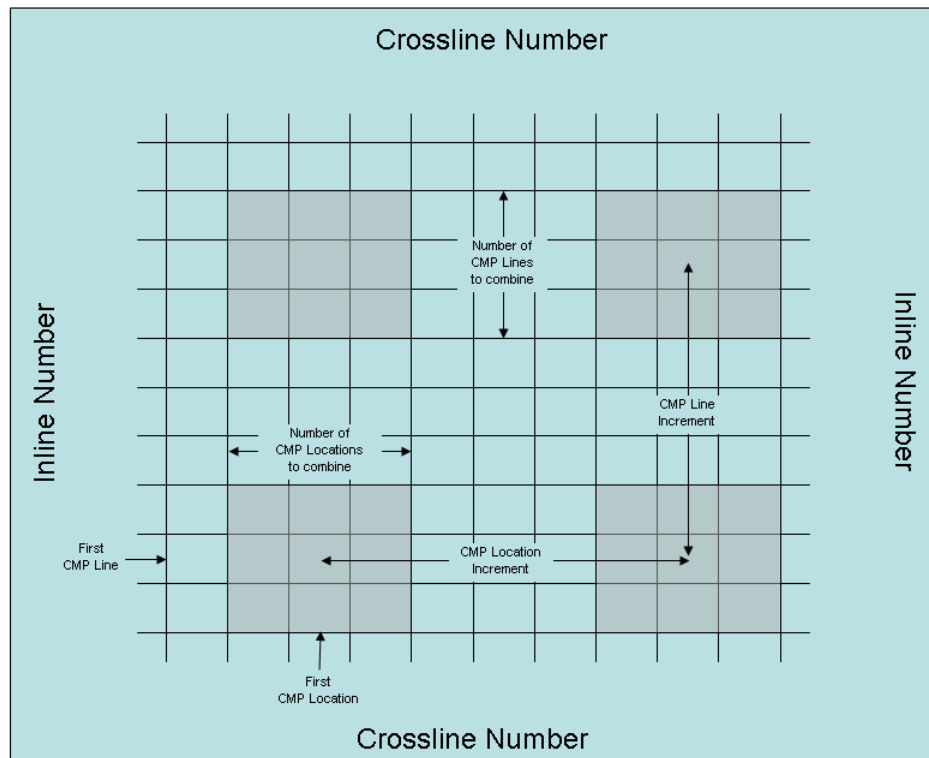


Illustration of parameters in the Build Supergathers step.

CMP Binning

Usage:

The CMP Binning process assigns CMP line and location numbers according to user specified coordinate parameters.

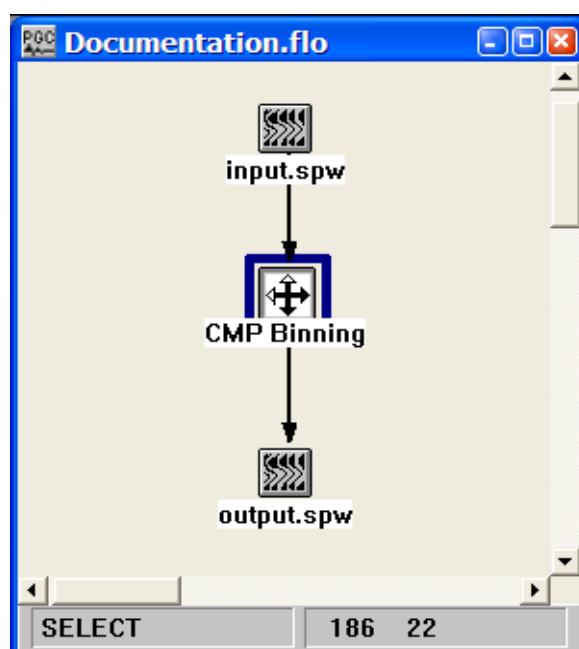
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

CMP Binning

CMP Binning

Easting [x] first corner	0.000000000	First CMP line number	1
Northing [y] first corner	0.000000000	Line increment	1
Easting [x] second corner	0.000000000	First CMP location number	1
Northing [y] second corner	1.000000000	CMP location increment	1
Easting [x] third corner	1.000000000		
Northing [y] third corner	0.000000000		
Bin size in-line (1 to 2)	1.000000000		
Bin size cross-line (1 to 3)	1.000000000		

OK Cancel

Parameter Description:

Easting (x) first corner — Enter the easting coordinate of the first corner of your survey.

Northing (y) first corner — Enter the northing coordinate of the first corner of your survey.

Easting (x) second corner — Enter the easting coordinate of the second corner of your survey.

Northing (y) second corner — Enter the northing coordinate of the second corner of your survey.

Easting (x) third corner — Enter the easting coordinate of the third corner of your survey.

Northing (y) third corner — Enter the northing coordinate of the third corner of your survey.

Bin size in-line (1 to 2) — Enter the size in distance units of the in-line side of each bin.

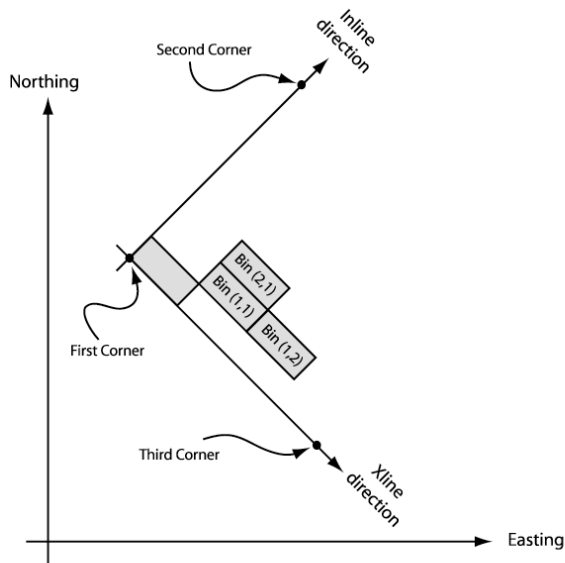
Bin size cross-line (1 to 3) — Enter the size in distance units of the cross-line side of each bin.

First CMP line number — Enter the first CMP line number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

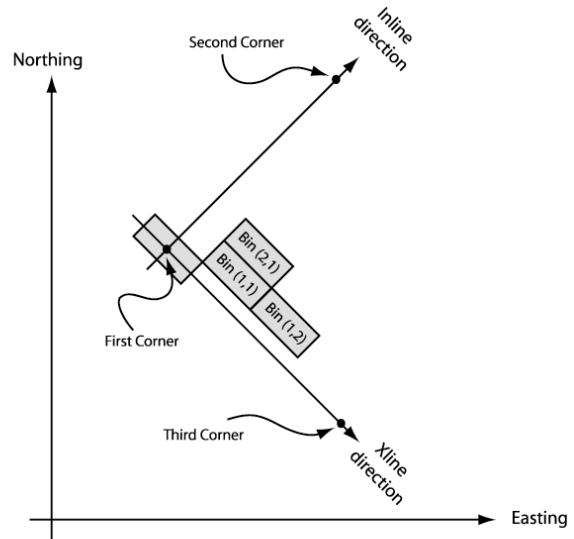
Line increment — Enter the increment in line numbers between adjacent CMP lines.

First CMP location number — Enter the first CMP location number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

CMP location increment — Enter the increment in locations between adjacent CMP locations.



Bin-corner survey definition



Bin-center survey definition

CMP Fold - Data

Usage:

The CMP Fold – Data step extracts CMP fold from the seismic data trace headers.

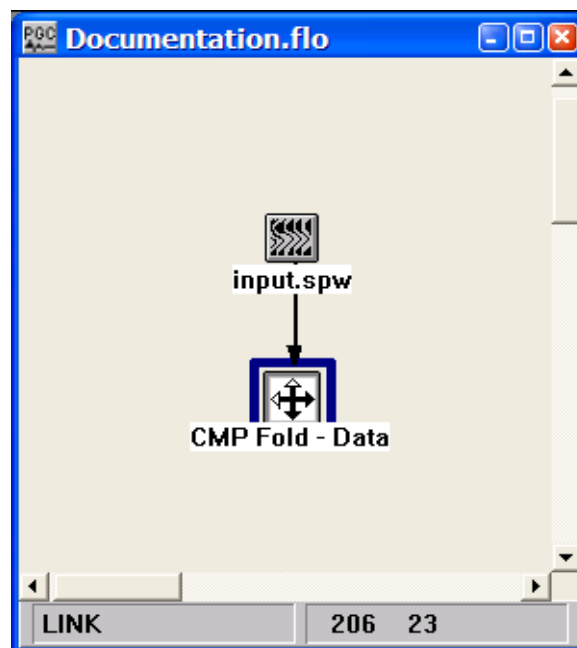
Input Links:

1) Seismic data in any sort order (mandatory).

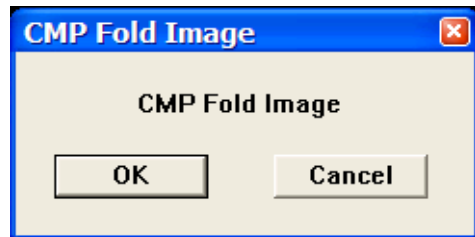
Output Links:

None

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

CMP Fold - Geometry

Usage:

The CMP Fold – Geometry step extracts CMP fold from the source, receiver, and cross-reference SPS card data files.

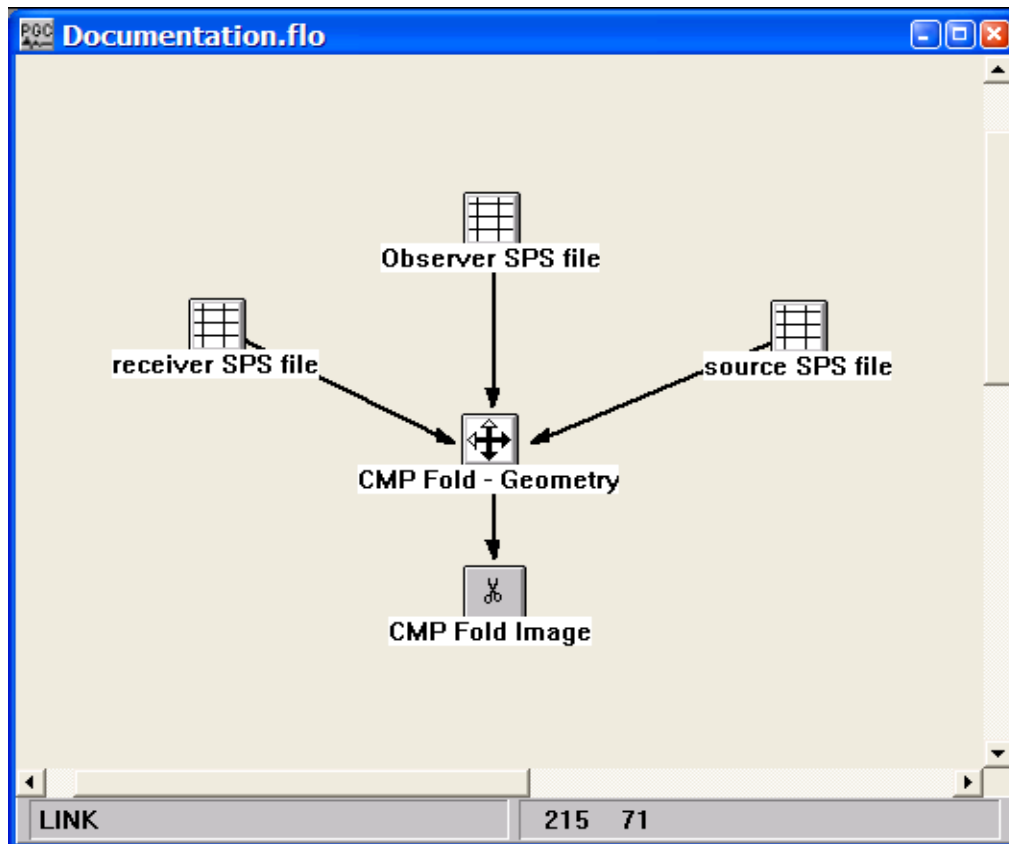
Input Links:

- 1) Observers Notes – SPS Format cards (mandatory).
- 2) Receiver Locations – SPS Format cards (mandatory).
- 3) Source Locations – SPS Format cards (mandatory).

Output Links:

- 1) CMP Fold Image file (mandatory).

Example Flowchart:



Step Parameter Dialog:

CMP Fold - Geometry			
Easting [x] first corner	0.000000000	First CMP line number	1
Northing [y] first corner	0.000000000	Line increment	1
Easting [x] second corner	0.000000000	First CMP location number	1
Northing [y] second corner	1.000000000	CMP location increment	1
Easting [x] third corner	1.000000000		
Northing [y] third corner	0.000000000		
Bin size in-line (1 to 2)	1.000000000		
Bin size cross-line (1 to 3)	1.000000000		

OK Cancel

Parameter Description:

Easting (x) first corner — Enter the easting coordinate of the first corner of your survey.

Northing (y) first corner — Enter the northing coordinate of the first corner of your survey.

Easting (x) second corner — Enter the easting coordinate of the second corner of your survey.

Northing (y) second corner — Enter the northing coordinate of the second corner of your survey.

Easting (x) third corner — Enter the easting coordinate of the third corner of your survey.

Northing (y) third corner — Enter the northing coordinate of the third corner of your survey.

Bin size in-line (1 to 2) — Enter the size in distance units of the in-line side of each bin.

Bin size cross-line (1 to 3) — Enter the size in distance units of the cross-line side of each bin.

First CMP line number — Enter the first CMP line number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

Line increment — Enter the increment in line numbers between adjacent CMP lines.

First CMP location number — Enter the first CMP location number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

CMP location increment — Enter the increment in locations between adjacent CMP locations.

Crooked Line Binning

Usage:

The Crooked Line Binning step assigns CMP line and location numbers to crooked line seismic data based on CMP easting and northing values. The CMP easting and northing values, along with easting and northing values for the sources and receivers, will have been placed in the trace headers through the use of SPS files with the Geometry Definition step. The CMP bins follow a best-fit line through the scatter of CMP positions. The best-fit line is determined by the Crooked Line Fit processing step and stored in a Line Definition card data file.

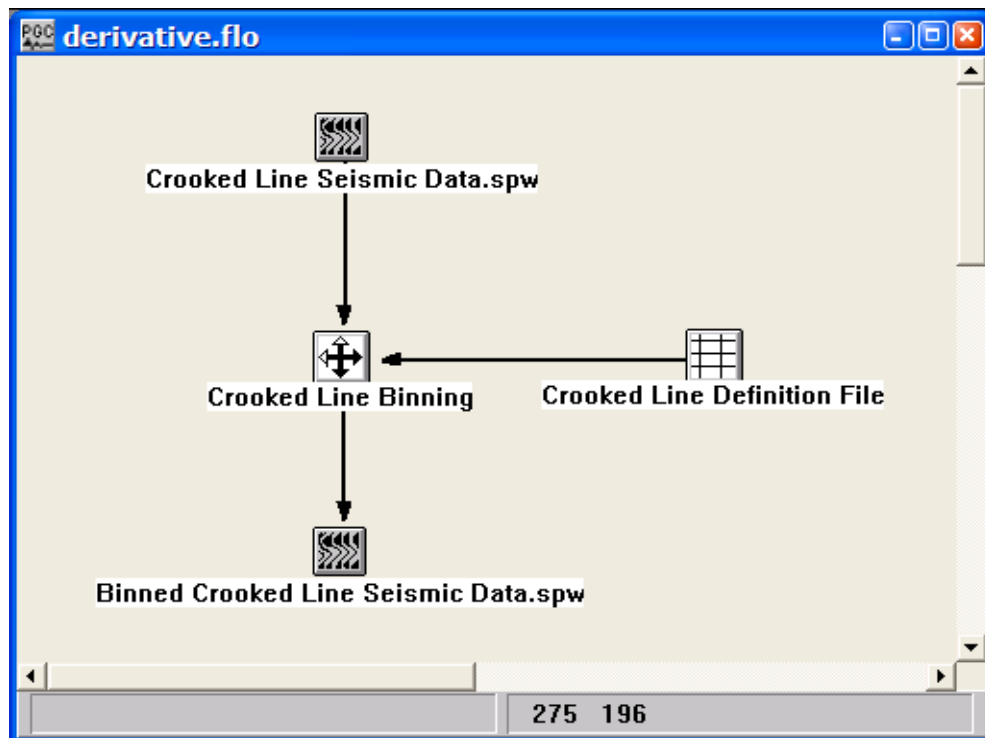
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Line Definition card data file (mandatory).

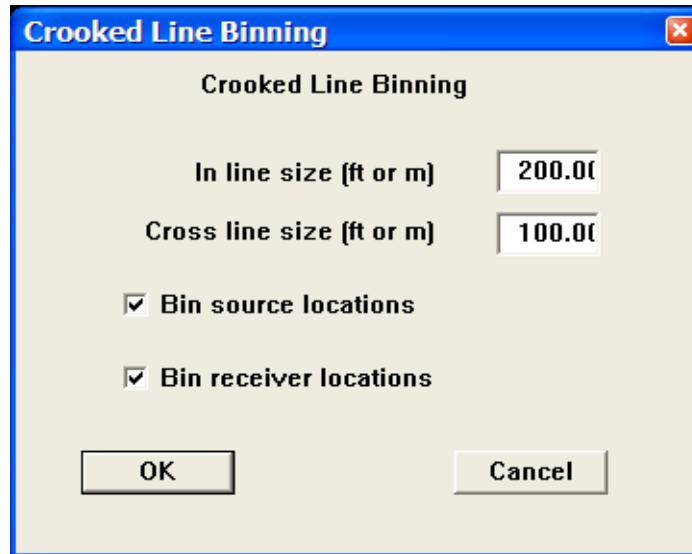
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Crooked Line Binning

Crooked Line Binning

In line size (ft or m) 200.00

Cross line size (ft or m) 100.00

☒ Bin source locations

☒ Bin receiver locations

OK Cancel

Parameter Description:

In line size (ft or m) — Enter the dimensions of the in-line bin dimension.

Cross line size (ft or m) — Enter the dimensions of the cross-line bin dimension.

Bin source locations — Select this option to bin source locations. With crooked line seismic data this is required for the calculation of surface consistent gains and residual statics.

Bin receiver locations — Select this option to bin receiver locations. With crooked line seismic data this is required for the calculation of surface consistent gains and residual statics.

Crooked Line Fit

Usage:

The Crooked Line Fit process determines a best-fit line through a scatter of CMP positions in a crooked line survey.

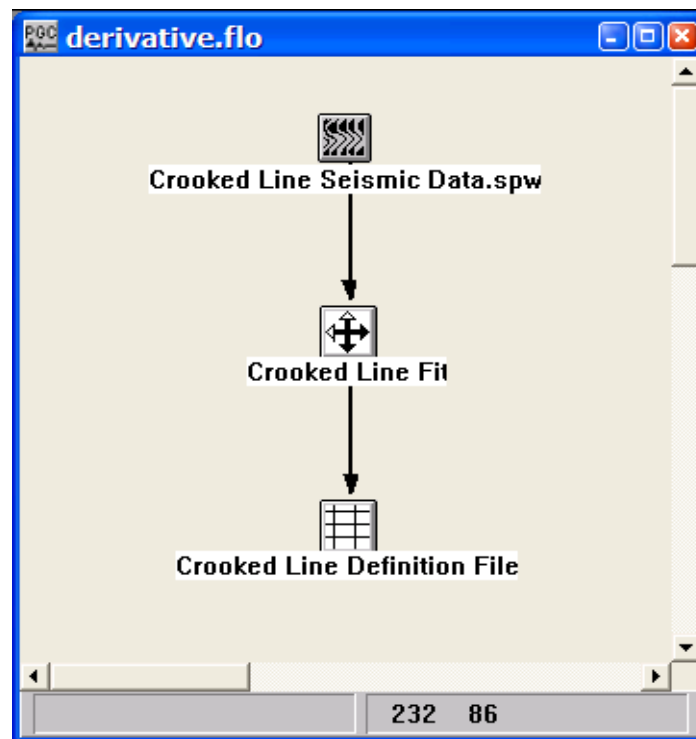
Input Links:

1) Seismic data in any sort order (mandatory).

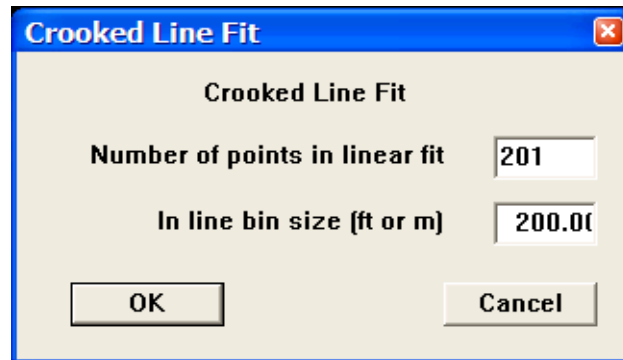
Output Links:

1) Line Definition File card data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Crooked Line Fit

Crooked Line Fit

Number of points in linear fit 201

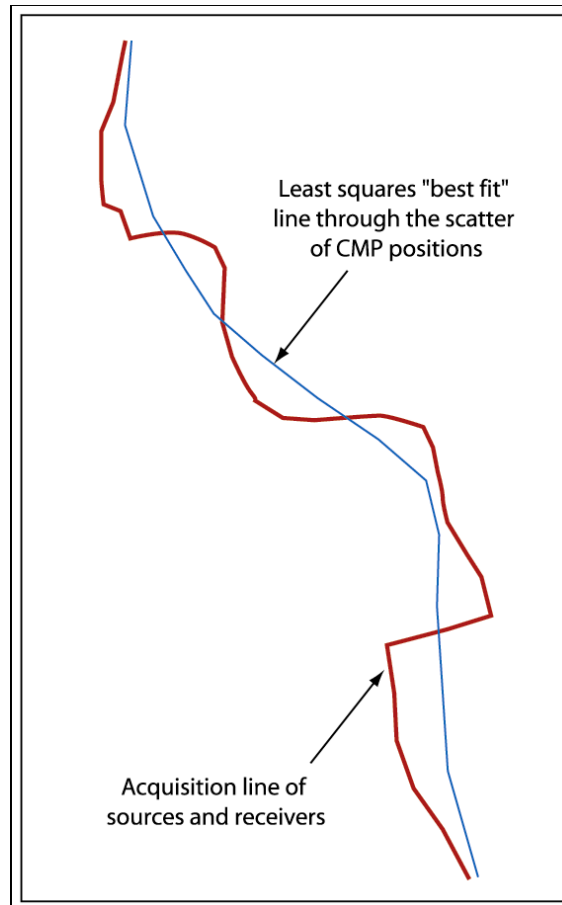
In line bin size (ft or m) 200.00

OK Cancel

Parameter Description:

Number of points in linear fit — Enter the number of CMP coordinate pairs used in determining the best fit line through the sources and receivers.

In-line bin size (ft or m) – Enter the dimensions of the in-line bin dimension along the direction of the best-fit line.



Best fit line through a scatter of source-receiver midpoints.

Extract Geometry

Usage:

The Extract Geometry step will extract geometry information from the seismic trace header and create source, receiver, and observer (i.e. cross reference) SPS card data files.

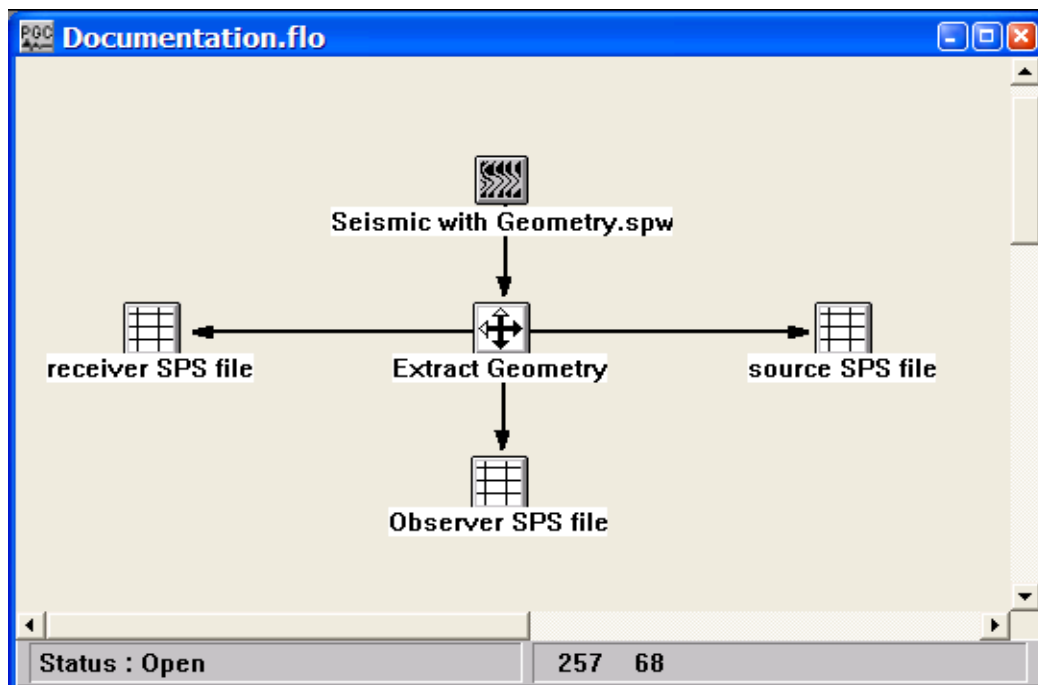
Input Links:

- 1) Seismic data in any sort order (mandatory).

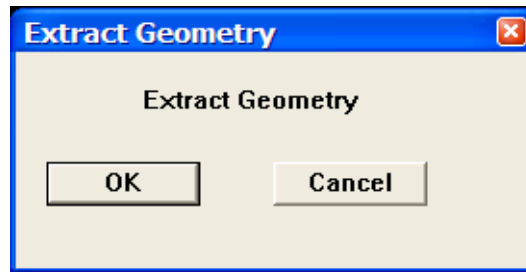
Output Links:

- 1) Source SPS card data file (mandatory).
- 2) Receiver SPS card data file (mandatory).
- 3) Observer SPS card data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Flex Binning

Usage:

The Flex Binning step is used to regularize fold in a 3D survey by borrowing traces from neighboring bins.

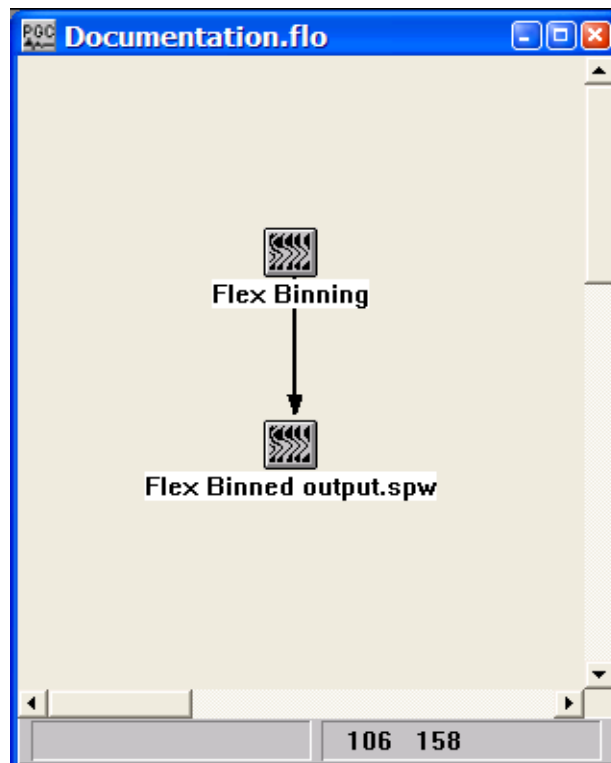
Input Links:

None – This process requires an input seismic disk file (mandatory).

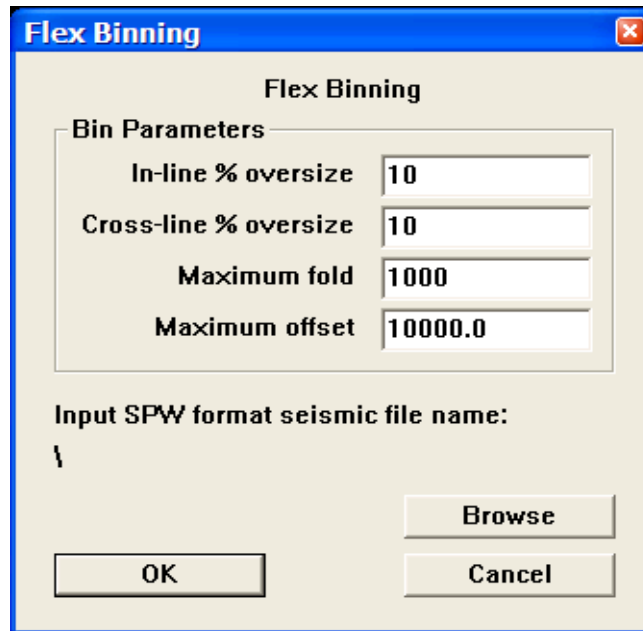
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Flex Binning". It contains a section labeled "Bin Parameters" with four input fields: "In-line % oversize" (value 10), "Cross-line % oversize" (value 10), "Maximum fold" (value 1000), and "Maximum offset" (value 10000.0). Below this is a text field for "Input SPW format seismic file name:" containing a backslash character. At the bottom are "OK", "Browse", and "Cancel" buttons.

Flex Binning	
Bin Parameters	
In-line % oversize	10
Cross-line % oversize	10
Maximum fold	1000
Maximum offset	10000.0
Input SPW format seismic file name: \\	
OK	Browse Cancel

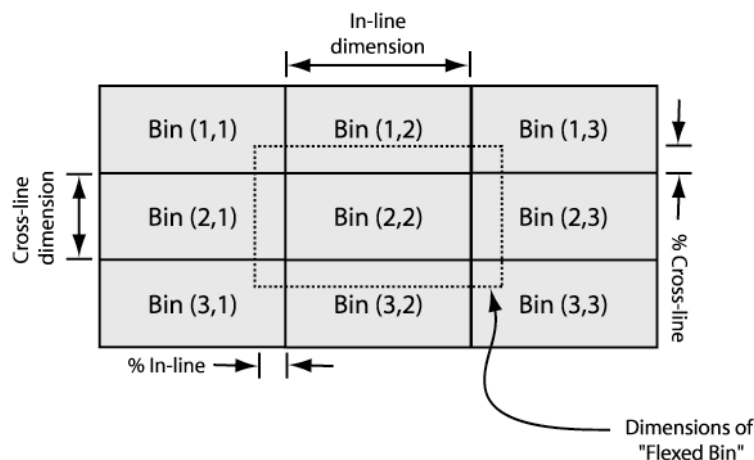
Parameter Description:

In-line % oversize — Enter the percent of the in-line bin dimension used to extend the bin in the in-line direction for the purpose of trace borrowing.

Cross-line % oversize — Enter the percent of the cross-line bin dimension used to extend the bin in the cross-line direction for the purpose of trace borrowing.

Maximum fold — Enter the maximum allowable fold attainable through flex binning.

Maximum offset — Enter the maximum allowable source-receiver offset among traces in neighboring bins used to increase fold.



Geometry Definition

Usage:

The Geometry Definition step assigns survey information to the trace headers based on the source, receiver, and observer notes SPS files. The Geometry Definition step assigns CMP number based on the source and receiver numbers using the following formula: $\text{CMP Location} = (\text{Source Location} + \text{Receiver Location}) / 2$. Therefore, for 2D lines it is imperative that source and receiver locations as defined in the SPS files share the same coordinate system. This implies that Source location 1 has the same X,Y position as Receiver location 1, and that Source location 2 has the same X,Y position as Receiver location 2, etc... In the case of 3D data, this is not an issue, as CMP Line and Location will be labeled by the CMP Binning step.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Observers Notes – SPS Format cards (mandatory).
- 3) Receiver Locations – SPS Format cards (mandatory).
- 4) Source Locations – SPS Format cards (mandatory).

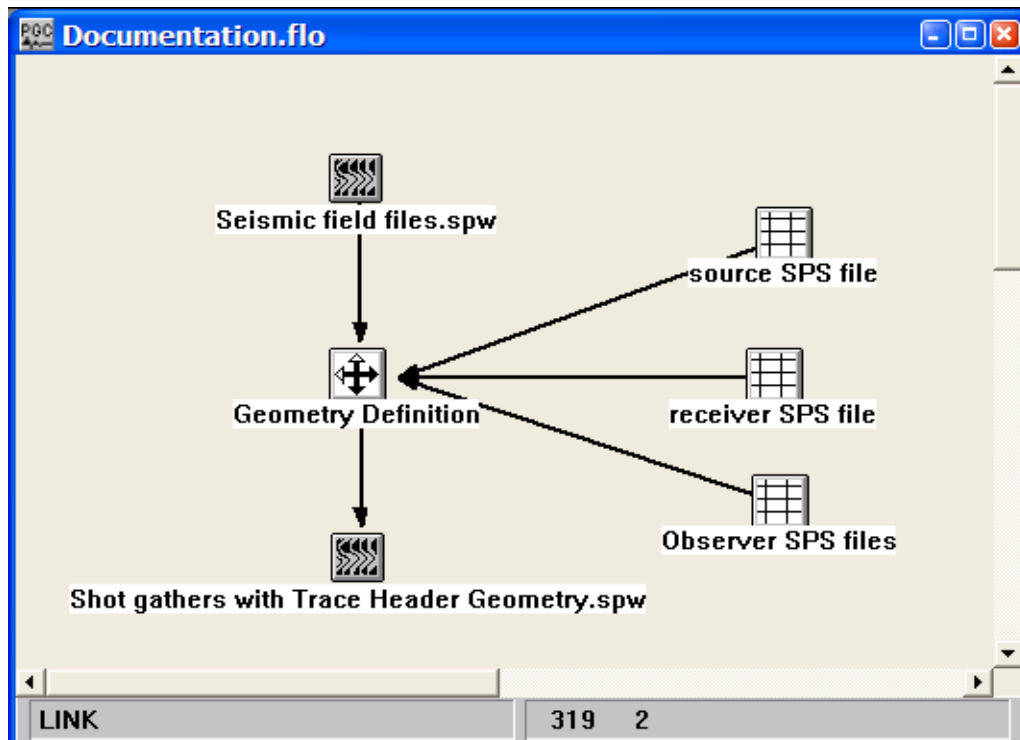
Output Links:

- 1) Seismic data in any sort order (mandatory).

References:

See Technical Note TN-Geom.doc

Example Flowchart:



Step Parameter Dialog:

Geometry Definition

☒ Kill undefined traces and records ☐ Use unsigned azimuths

☐ Use unsigned offsets ☐ Zero degrees azimuth = East

Nominal receiver interval ☒ Zero degrees azimuth = North

☐ Define survey orientation for signed offsets

Enter survey orientation (Receiver line azimuth)

Parameter Description:

Kill undefined traces and records — If checked, any traces or records that are not represented in the SPS files will be marked as dead.

Use unsigned offsets — If checked, the offset values written to the seismic header will be unsigned.

Nominal receiver interval — Enter the nominal interval between receiver stations in distance units.

Use unsigned azimuths — If checked, the azimuth values written to the seismic header will range from 0 to 360 degrees, with zero degrees of azimuth equal to the user-specified direction. By default, azimuth values are signed and range from 0 to +/-180 degrees, with zero degrees of azimuth equal to the user-specified direction.

Zero degrees azimuth = East — If selected, then zero degrees of source-receiver azimuth will be set equal to due East.

Zero degrees azimuth = North — If selected, then zero degrees of source-receiver azimuth will be set equal to due North.

Define survey orientation for signed offsets — If checked, the sign on offset values will be adjusted for the orientation of the dominant receiver line azimuth, such that offset up-the-spread will be positive, and offsets down-the-spread will be negative.

Enter survey orientation (Receiver line azimuth) — Enter the value of the receiver line azimuth with respect to West that will be used to assign signs to source-receiver offsets.

Geometry Definition Example:

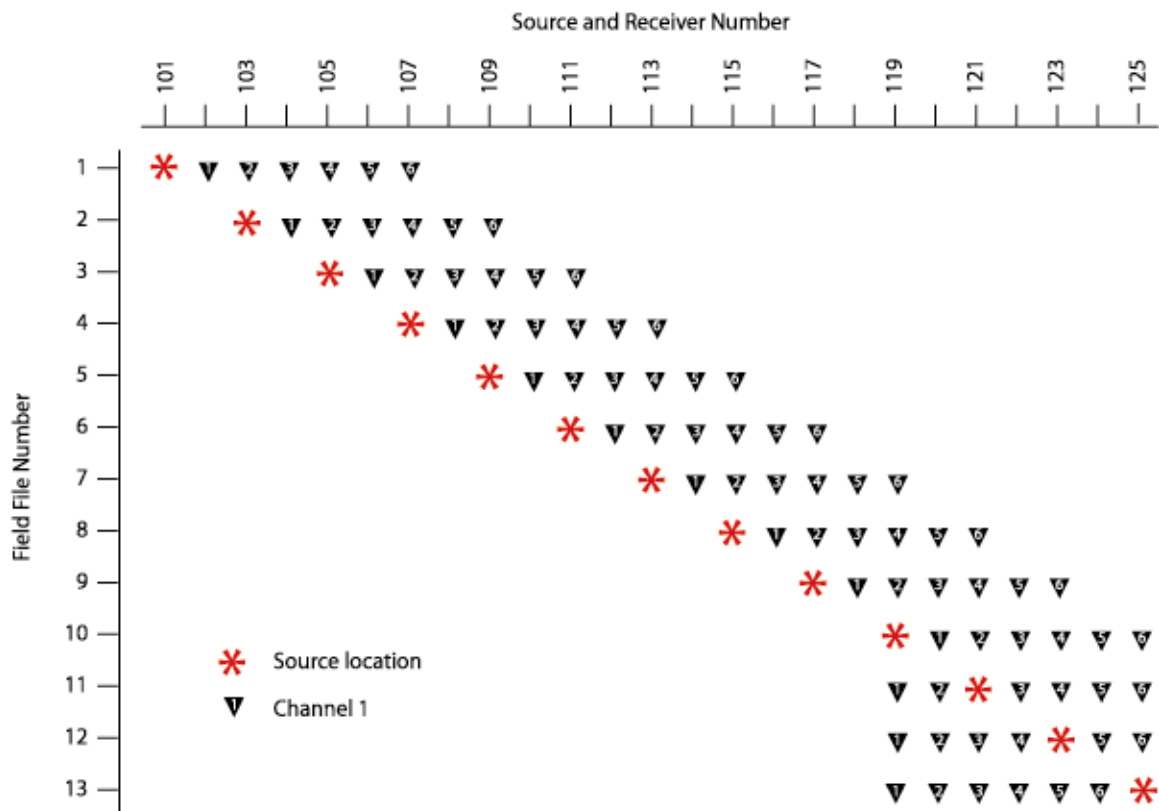
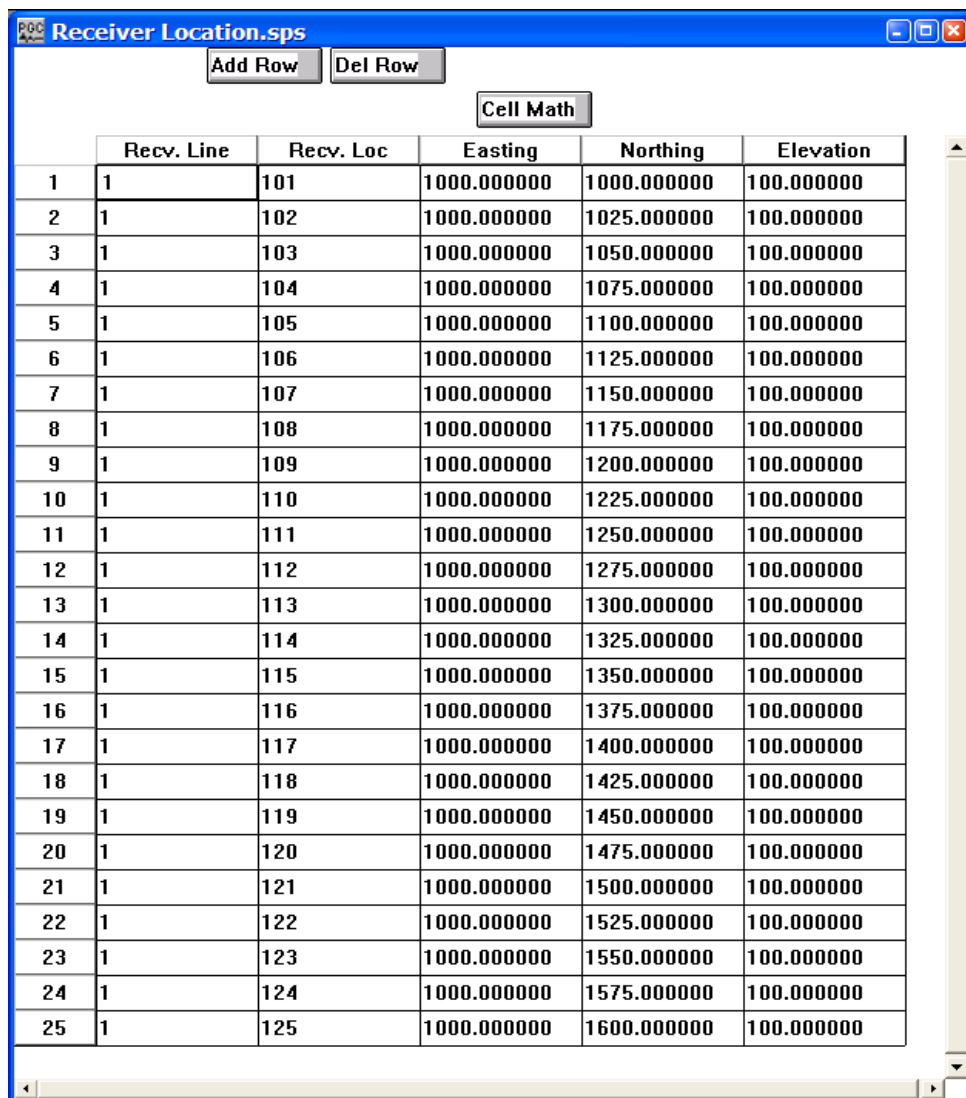


Figure 1. 2D seismic survey consisting of a 6-channel spread and a 25-m station interval. The spread “rolls-off” at the end of the line.

Source Location.sps

	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	1000.000000	1000.000000	100.000000
2	1	103	1000.000000	1050.000000	100.000000
3	1	105	1000.000000	1100.000000	100.000000
4	1	107	1000.000000	1150.000000	100.000000
5	1	109	1000.000000	1200.000000	100.000000
6	1	111	1000.000000	1250.000000	100.000000
7	1	113	1000.000000	1300.000000	100.000000
8	1	115	1000.000000	1350.000000	100.000000
9	1	117	1000.000000	1400.000000	100.000000
10	1	119	1000.000000	1450.000000	100.000000
11	1	121	1000.000000	1500.000000	100.000000
12	1	123	1000.000000	1550.000000	100.000000
13	1	125	1000.000000	1600.000000	100.000000

Figure 2. Source SPS file corresponding to the survey illustrated in figure 1.



	Recv. Line	Recv. Loc	Easting	Northing	Elevation
1	1	101	1000.000000	1000.000000	100.000000
2	1	102	1000.000000	1025.000000	100.000000
3	1	103	1000.000000	1050.000000	100.000000
4	1	104	1000.000000	1075.000000	100.000000
5	1	105	1000.000000	1100.000000	100.000000
6	1	106	1000.000000	1125.000000	100.000000
7	1	107	1000.000000	1150.000000	100.000000
8	1	108	1000.000000	1175.000000	100.000000
9	1	109	1000.000000	1200.000000	100.000000
10	1	110	1000.000000	1225.000000	100.000000
11	1	111	1000.000000	1250.000000	100.000000
12	1	112	1000.000000	1275.000000	100.000000
13	1	113	1000.000000	1300.000000	100.000000
14	1	114	1000.000000	1325.000000	100.000000
15	1	115	1000.000000	1350.000000	100.000000
16	1	116	1000.000000	1375.000000	100.000000
17	1	117	1000.000000	1400.000000	100.000000
18	1	118	1000.000000	1425.000000	100.000000
19	1	119	1000.000000	1450.000000	100.000000
20	1	120	1000.000000	1475.000000	100.000000
21	1	121	1000.000000	1500.000000	100.000000
22	1	122	1000.000000	1525.000000	100.000000
23	1	123	1000.000000	1550.000000	100.000000
24	1	124	1000.000000	1575.000000	100.000000
25	1	125	1000.000000	1600.000000	100.000000

Figure 3. Receiver SPS file corresponding to the survey illustrated in figure 1.

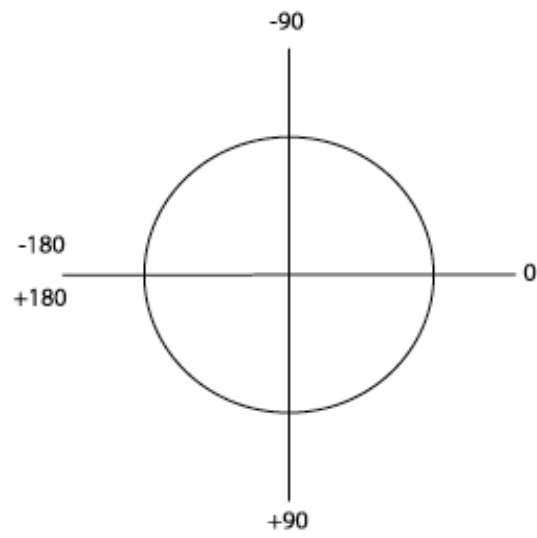
Observer Notes.sps

Add Row Del Row

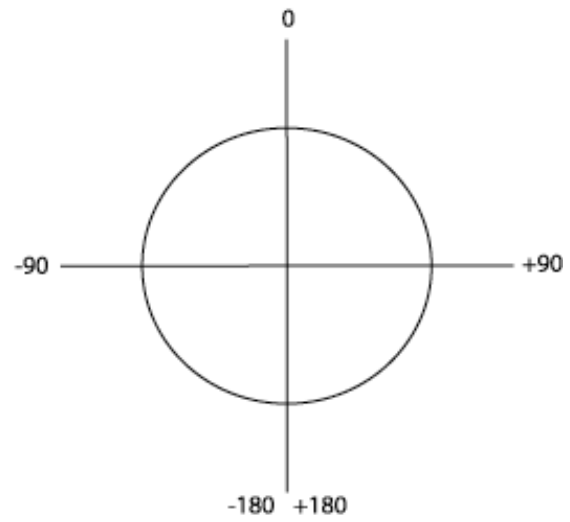
Cell Math

	Field File	Src. Line	Src. Loc	First Channel	Last Channel	Channel Incr.	Recv. Line	First Recv.	Recv. Incr.
1	1	1	101	1	6	1	1	102	1
2	2	1	103	1	6	1	1	104	1
3	3	1	105	1	6	1	1	106	1
4	4	1	107	1	6	1	1	108	1
5	5	1	109	1	6	1	1	110	1
6	6	1	111	1	6	1	1	112	1
7	7	1	113	1	6	1	1	114	1
8	8	1	115	1	6	1	1	116	1
9	9	1	117	1	6	1	1	118	1
10	10	1	119	1	6	1	1	120	1
11	11	1	121	1	2	1	1	119	1
12	11	1	121	3	6	1	1	122	1
13	12	1	123	1	4	1	1	119	1
14	12	1	123	5	6	1	1	124	1
15	13	1	125	1	6	1	1	119	1

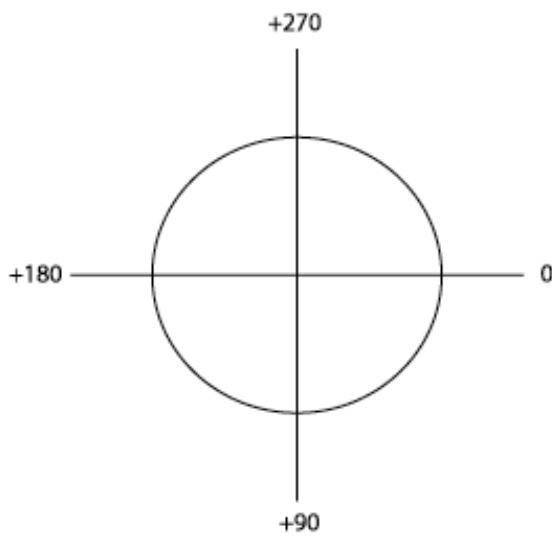
Figure 4. Observer SPS file corresponding to the survey illustrated in figure 1.



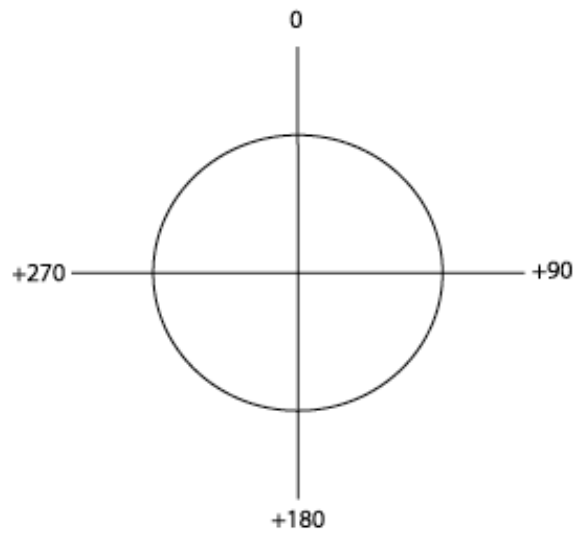
Case 1: $0^\circ = \text{East}$, Signed Azimuths



Case 2: $0^\circ = \text{North}$, Signed Azimuths



Case 3: $0^\circ = \text{East}$, Unsigned Azimuths



Case 4: $0^\circ = \text{North}$, Unsigned Azimuths

Figure 5. Definition of azimuths using the Geometry Definition parameters.

Geometry Interpolation

Usage:

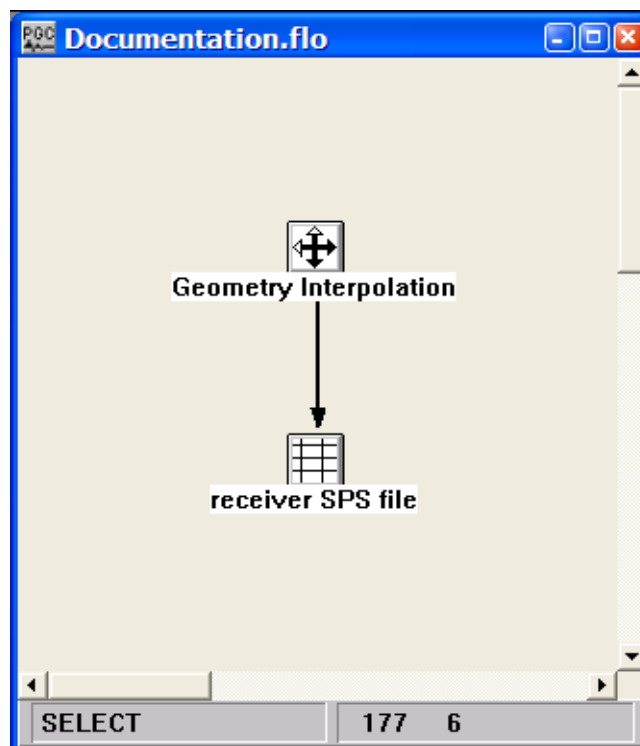
The Geometry Interpolation step.

Input Links:

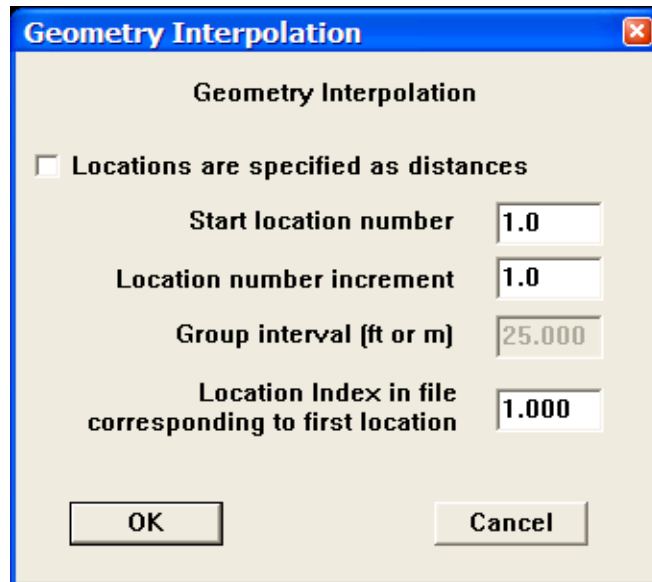
None – This process requires an input seismic disk file (mandatory).

Output Links:

1) Receiver SPS file (mandatory).

Example Flowchart:

Step Parameter Dialog:



The image shows a software dialog box titled "Geometry Interpolation". It has a standard Windows-style title bar with a close button. The dialog contains a checkbox labeled "Locations are specified as distances" which is currently unchecked. Below this checkbox are four input fields, each with a label and a text box containing a value: "Start location number" with "1.0", "Location number increment" with "1.0", "Group interval (ft or m)" with "25.000", and "Location Index in file corresponding to first location" with "1.000". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter	Value
Start location number	1.0
Location number increment	1.0
Group interval (ft or m)	25.000
Location Index in file corresponding to first location	1.000

Parameter Description:

Locations are specified as distances — If checked, the group interval is manually defined.

Start location number — Enter the number of the first receiver location

Location number increment — Enter the receiver increment

Group interval — Distance between receiver groups in feet or meters.

Location index in file corresponding to first location —

PreStack Kirchhoff Partitioning

Usage:

Pre-Stack Time Migration (PTM) is a very compute intensive process, and large migration apertures can result in the traces of a single CMP gather being migrated to a large number of output migration bins. As a result, in addition to the disk space required to hold the input data set, the migration also requires a working data store. Proper sizing of the working data set size can greatly improve the processing speed of the migration. The Pre-Stack Kirchhoff Partitioning step identifies the input traces that will contribute to a specified output set of migration bins and creates an input data volume from the candidate CMP gathers. By partitioning the output data volume to fit within system memory limits, the migration run time can be optimized. The resultant migrations are conveniently merged with the Tape Utility.

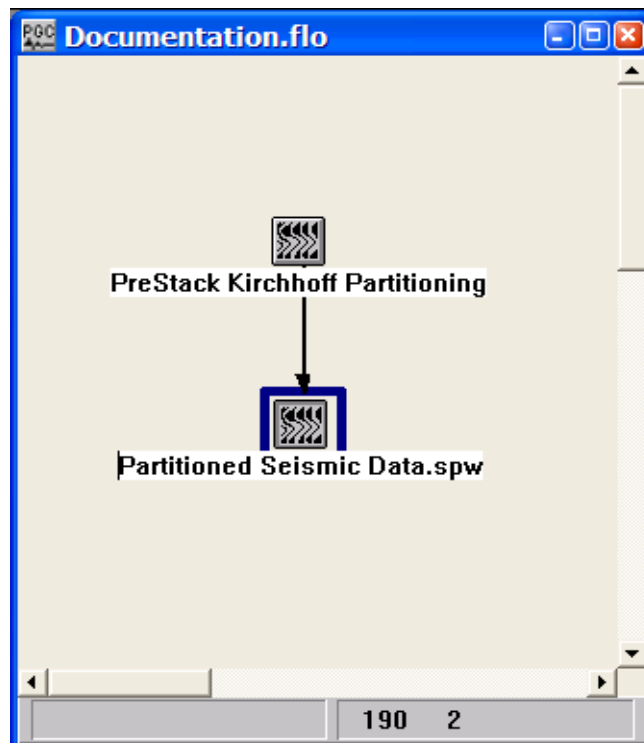
Input Links:

None - This process requires an input seismic disk file (mandatory).

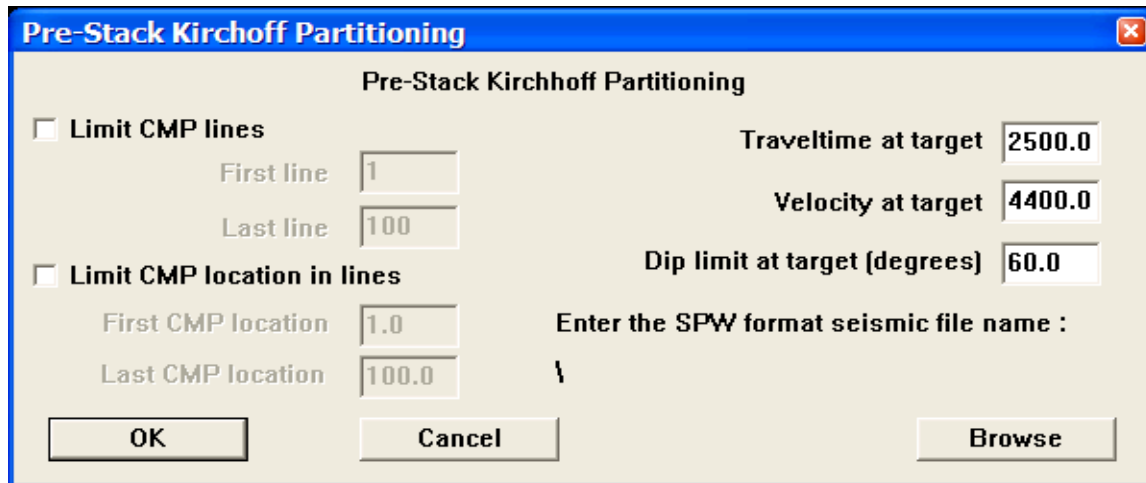
Output Links:

1) Seismic data partitioned for Pre-Stack Kirchhoff Time Migration (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Pre-Stack Kirchhoff Partitioning" and contains the following fields and controls:

- ☐ **Limit CMP lines**
 - First line:
 - Last line:
- ☐ **Limit CMP location in lines**
 - First CMP location:
 - Last CMP location:
- Traveltime at target:
- Velocity at target:
- Dip limit at target (degrees):
- Enter the SPW format seismic file name :
- Buttons: OK, Cancel, Browse

Parameter Description:

Limit CMP lines — If checked, allows selection of input traces that will contribute to the selected CMP lines during migration.

First line – Enter the first output line for PSTM partitioning.

Last line – Enter the last output line for PSTM partitioning.

Limit CMP location in lines — If checked, allows selection of input traces that will contribute to the selected CMP locations in the previously selected CMP lines during migration.

First CMP location – Enter the first output location for PSTM partitioning.

Last CMP location – Enter the last output location for PSTM partitioning.

Traveltime at target — Estimated travel time of target event. This time is used to estimate candidate CMP bins for Pre-Stack Kirchhoff partitioning.

Velocity at target — Velocity of target event. This value is used to estimate the aperture of the migration operator, and therefore the candidate CMP bins for Pre-Stack Kirchhoff partitioning.

Dip limit at target – Estimated dip limit of target event. This value is used to estimate the aperture of the migration operator, and therefore the candidate CMP bins for Pre-Stack Kirchhoff partitioning.

Enter the SPW format seismic file name – Using the Browse button, select the input file to be partitioned for Pre-Stack Kirchhoff Time Migration.

Simple Marine Geometry

Usage:

The Simple Marine Geometry step assigns geometry information to the seismic trace headers based on a survey information contained in the Streamer Definition card data.

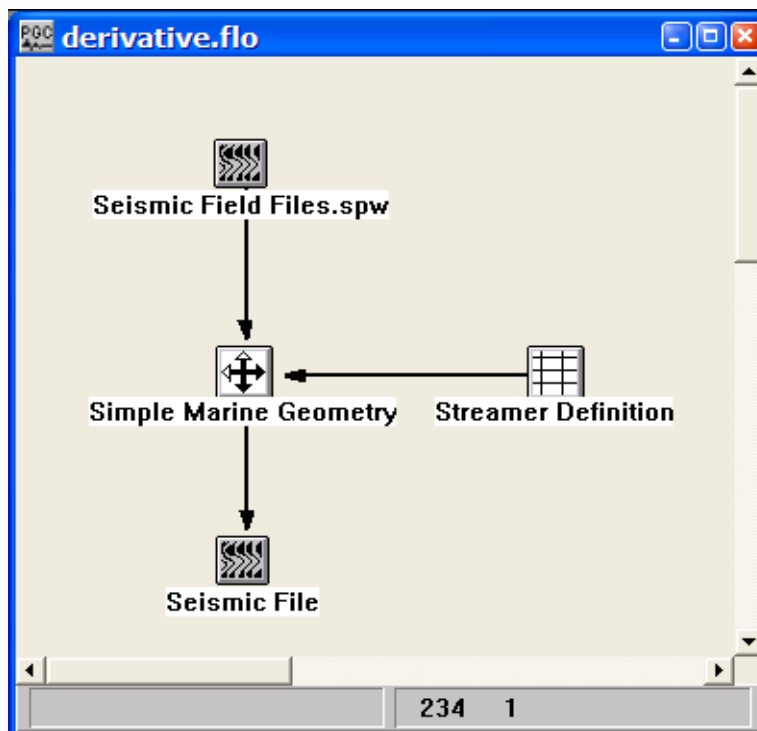
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Streamer Definition card data (mandatory).

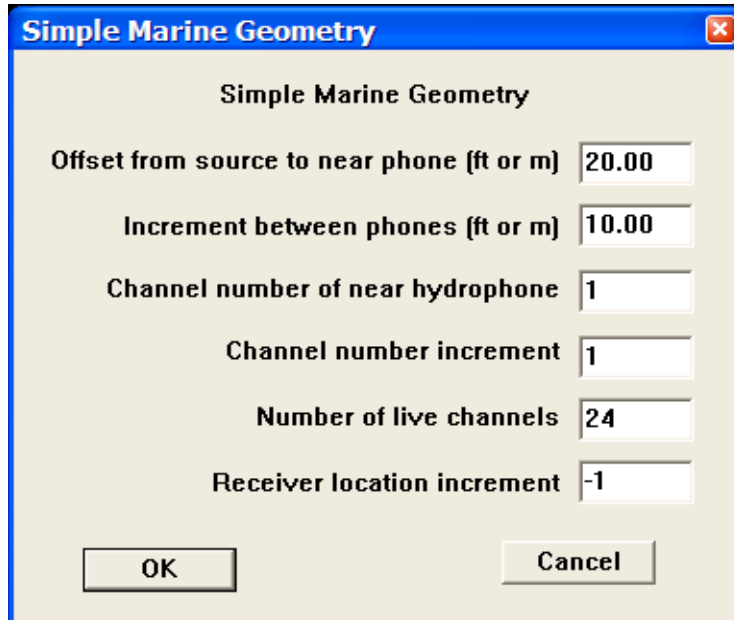
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

A screenshot of a software dialog box titled "Simple Marine Geometry". The dialog box has a blue title bar with a close button (X) in the top right corner. The main area is light beige and contains six labeled input fields, each with a text box to its right. The labels and values are: "Offset from source to near phone (ft or m)" with value "20.00", "Increment between phones (ft or m)" with value "10.00", "Channel number of near hydrophone" with value "1", "Channel number increment" with value "1", "Number of live channels" with value "24", and "Receiver location increment" with value "-1". At the bottom of the dialog are two buttons: "OK" on the left and "Cancel" on the right.

Simple Marine Geometry

Offset from source to near phone (ft or m) 20.00

Increment between phones (ft or m) 10.00

Channel number of near hydrophone 1

Channel number increment 1

Number of live channels 24

Receiver location increment -1

OK Cancel

Parameter Description:

Offset from source to near phone (ft or m) — Enter the nominal interval between source and the first receiver in distance units.

Increment between phones (ft or m) — Enter the nominal interval between phones in distance units.

Channel number of near hydrophone — Enter the channel number assigned in the trace headers to the closest hydrophone on the cable.

Channel number increment — Enter the increment between channels.

Number of live channels — Enter the number of live channels recorded per shot point.

Receiver location increment — Enter the increment between receiver locations.

Single Fold Profile Geometry

Usage:

The Single Fold Profile Geometry step allows you to assign geometry for single fold lines and GPR data lines.

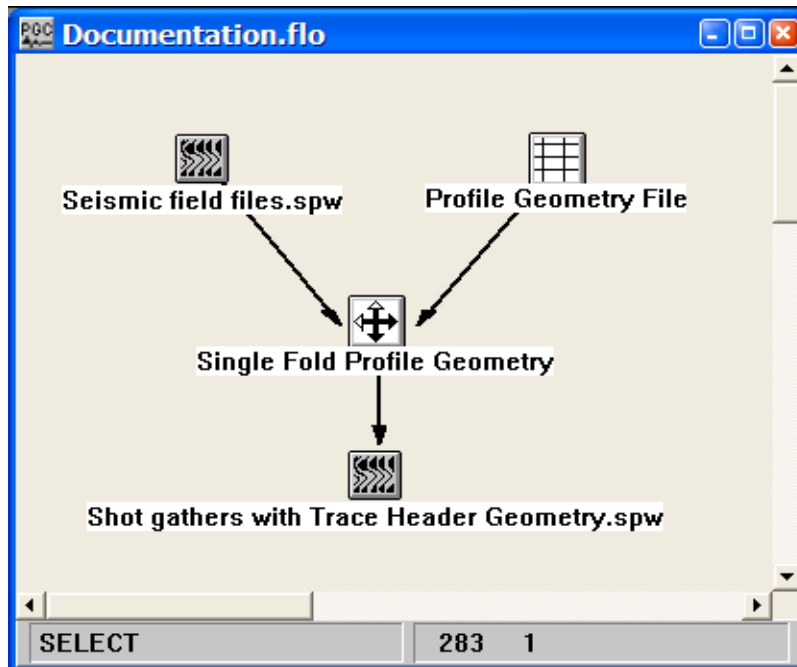
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Profile Geometry File cards (optional).

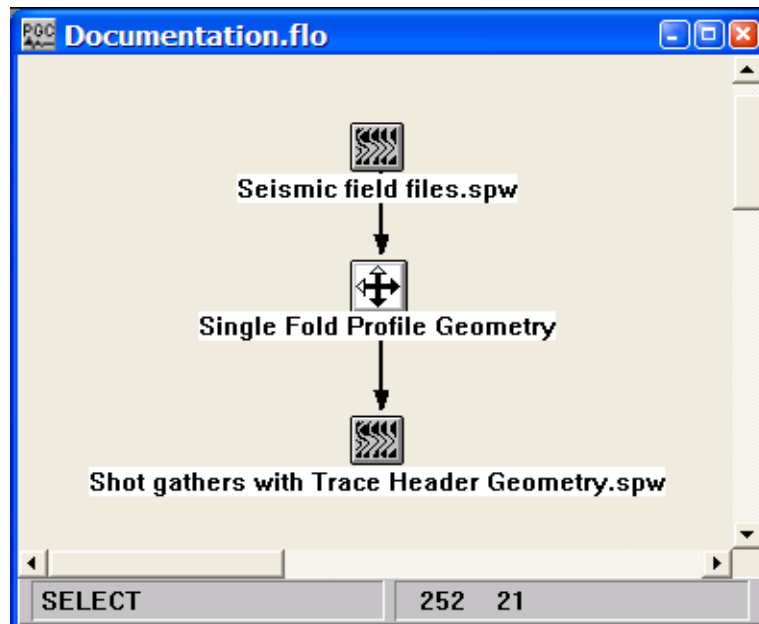
Output Links:

- 1) Seismic data in any sort order (mandatory).

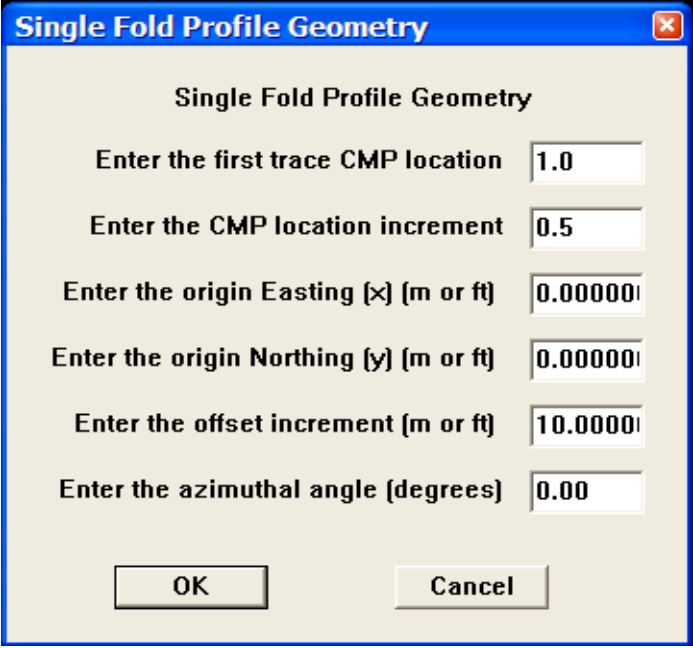
Example Flowchart:



Or



Step Parameter Dialog:



The image shows a software dialog box titled "Single Fold Profile Geometry". It contains six input fields with labels and values, and two buttons at the bottom.

Label	Value
Enter the first trace CMP location	1.0
Enter the CMP location increment	0.5
Enter the origin Easting (x) (m or ft)	0.00000
Enter the origin Northing (y) (m or ft)	0.00000
Enter the offset increment (m or ft)	10.0000
Enter the azimuthal angle (degrees)	0.00

Buttons: OK, Cancel

Parameter Description:

Enter the first trace CMP location — Enter the CMP location of the first trace.

Enter the CMP location increment — Enter the CMP location increment between traces.

Enter the origin Easting (x) (m or ft) — Enter the Easting of the first trace in this line.

Enter the origin Northing (y) (m or ft) — Enter the Northing of the first trace in this line.

Enter the offset increment (m or ft) — Enter the nominal interval between traces in distance units.

Enter the azimuthal angle — Enter the angle from north for this line.

UKOOA P1/90 Geometry

Usage:

The UKOOA P1/90 Geometry step.

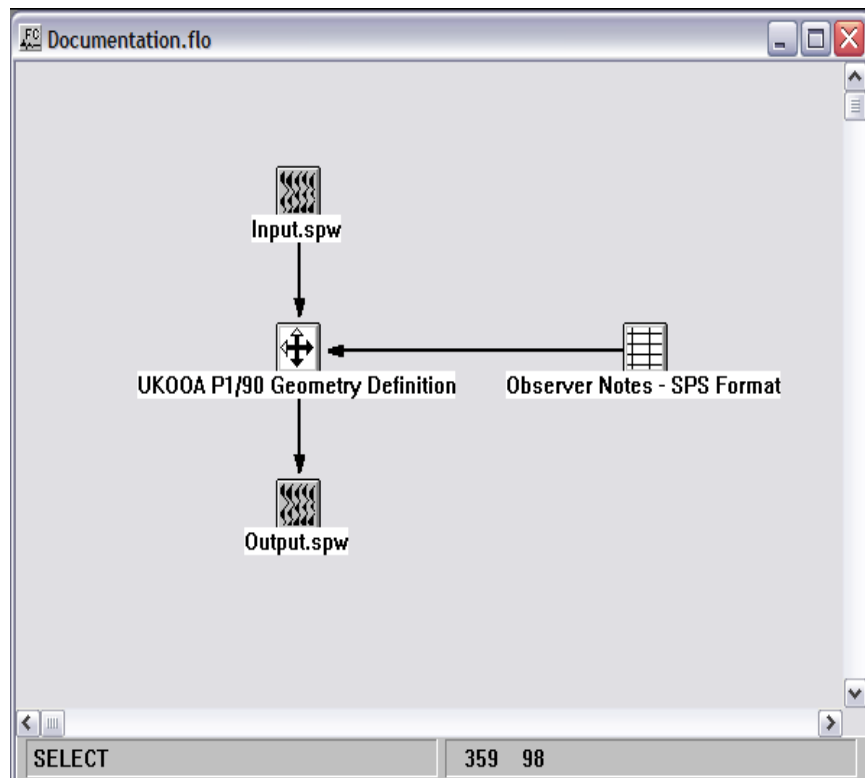
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) SPS Observer notes (mandatory). For the UKOOA P1/90 Geometry step, on the field file, source line, and source location fields are required in the Observer notes.

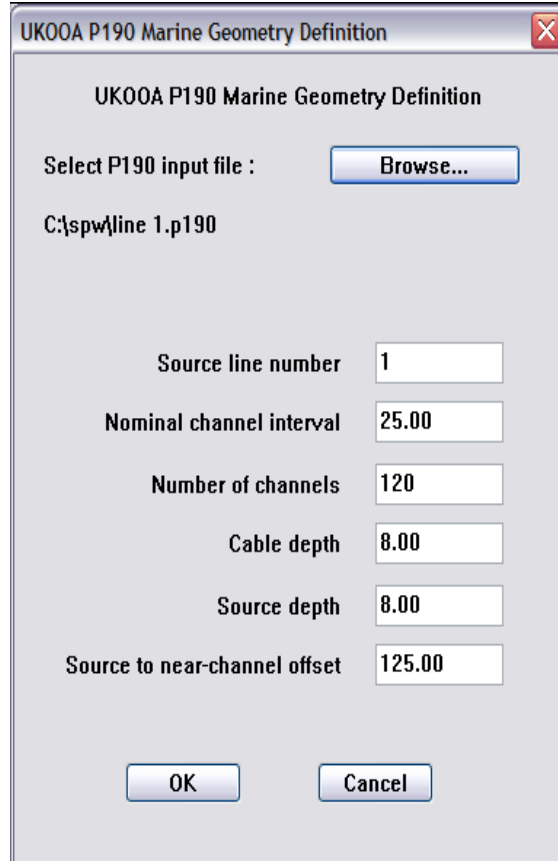
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "UK00A P190 Marine Geometry Definition". It contains a "Select P190 input file :" label with a "Browse..." button. Below this, the file path "C:\spw\line 1.p190" is displayed. There are six input fields with labels: "Source line number" (value 1), "Nominal channel interval" (value 25.00), "Number of channels" (value 120), "Cable depth" (value 8.00), "Source depth" (value 8.00), and "Source to near-channel offset" (value 125.00). At the bottom are "OK" and "Cancel" buttons.

Parameter	Value
Source line number	1
Nominal channel interval	25.00
Number of channels	120
Cable depth	8.00
Source depth	8.00
Source to near-channel offset	125.00

Parameter Description:

Select P190 input file – Use the Browse... button to select the P1/90 text file that contains the source, and potentially the receiver, coordinate information.

Source line number — Enter the source/sail line number corresponding to the selected P1/90 coordinate file.

Nominal channel interval — Enter the spacing between channels on the cable.

Number of channels – Enter the number of channels in the cable.

Cable depth – Enter the depth of the cable below sea level.

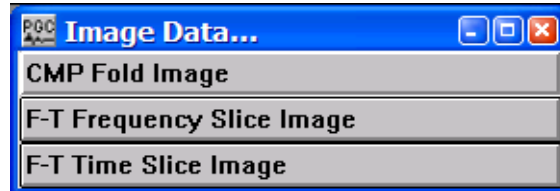
Source depth – Enter the depth of the source below sea level.

Source to near-channel offset – Enter the distance between the source and the nearest channel in the cable.

Image data

This section documents the processing steps available for the creation of Image Data.

The types of Image Data currently available are:



CMP Fold Image

Usage:

The CMP Fold Image step allows you to select or name an image file on disk. It is the output SPW image format file for the fold diagram.

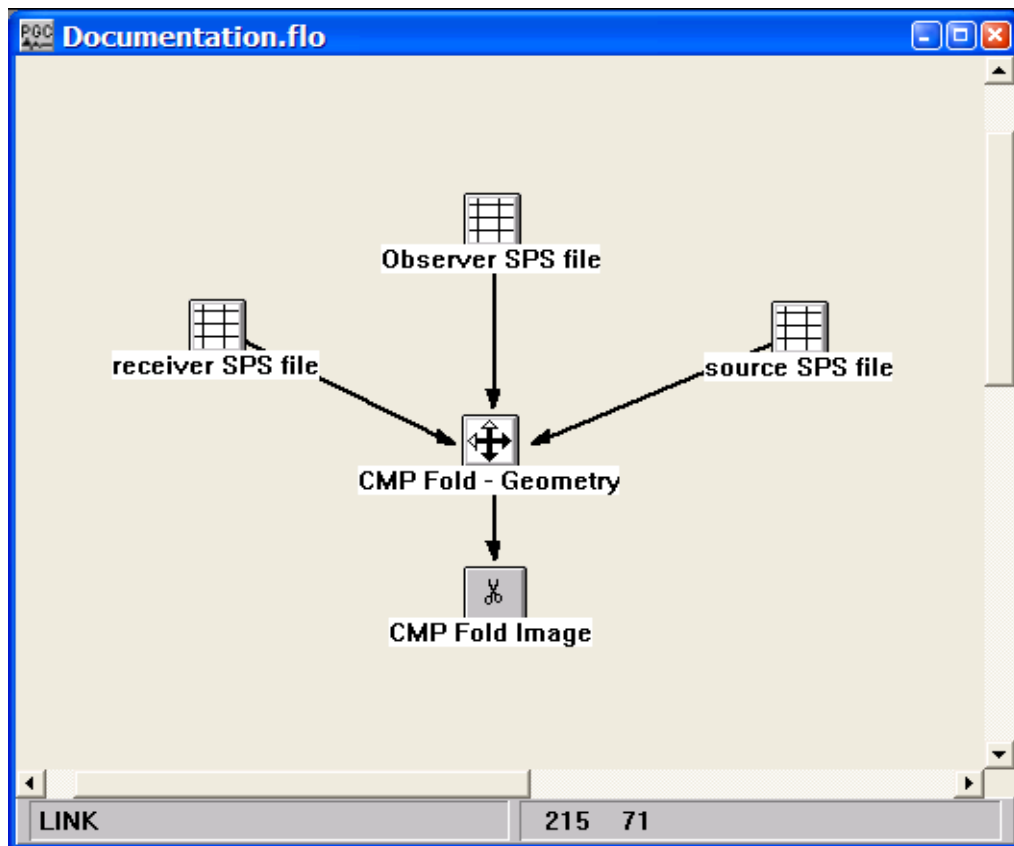
Input Links:

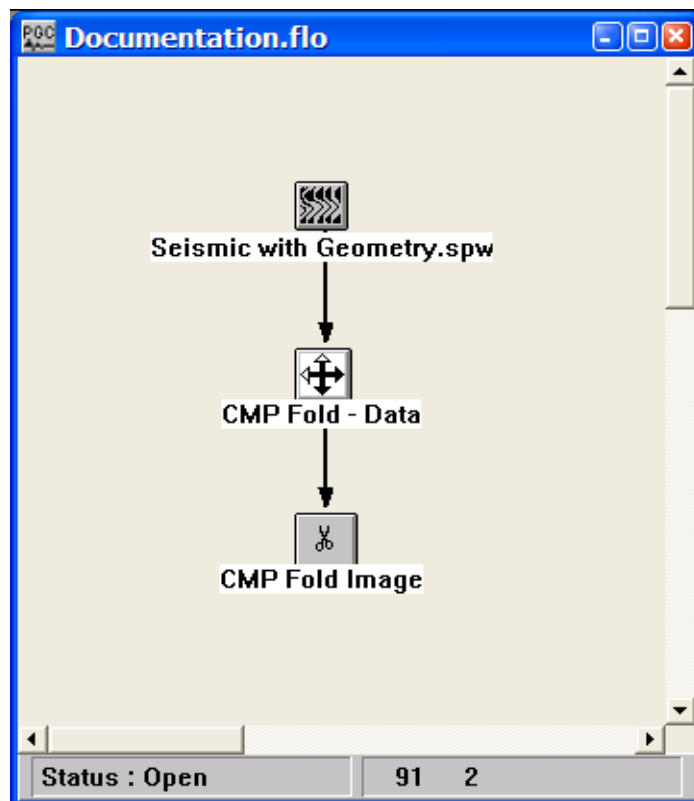
- 1) This process requires input from the CMP Fold – Geometry or the CMP Fold – Data steps.

Output Links:

None - This process requires a SPW image format disk file.

Example Flowcharts:





Or,

Step Parameter Dialog:



Parameter Description:

Enter the name of the Image format disk file that will contain the CMP Fold image.

F-T Frequency Slice Image

Usage:

The F-T Frequency Slice Image step allows you to select or name an image file on disk. It is the output SPW image format file for the F-T Frequency slice data.

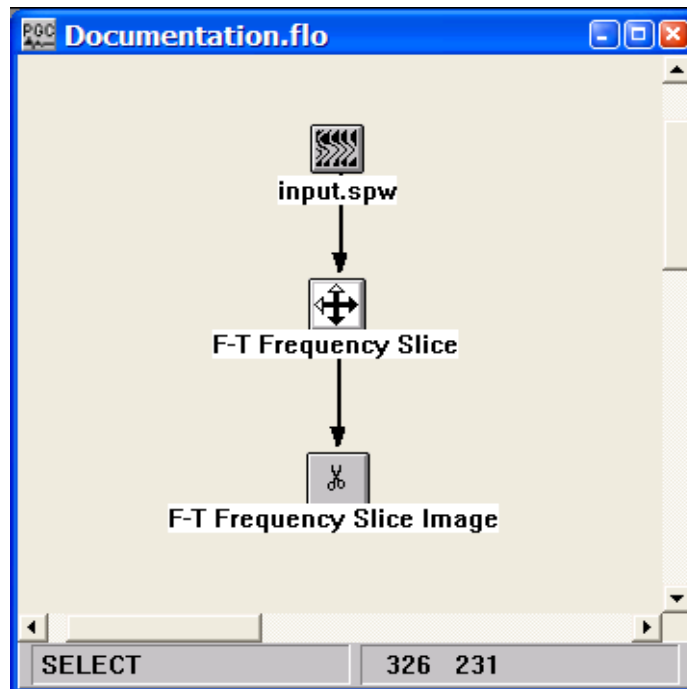
Input Links:

1) The F-T Frequency Slice Image receives the output from the F-T Frequency Slice step.

Output Links:

None – This process requires a SPW image format disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Enter the name of the Image format disk file that will contain the F-T Frequency Slice Image.

F-T Time Slice Image

Usage:

The F-T Time Slice Image step allows you to select or name an image file on disk. It is the output SPW image format file for the F-T Time slice data.

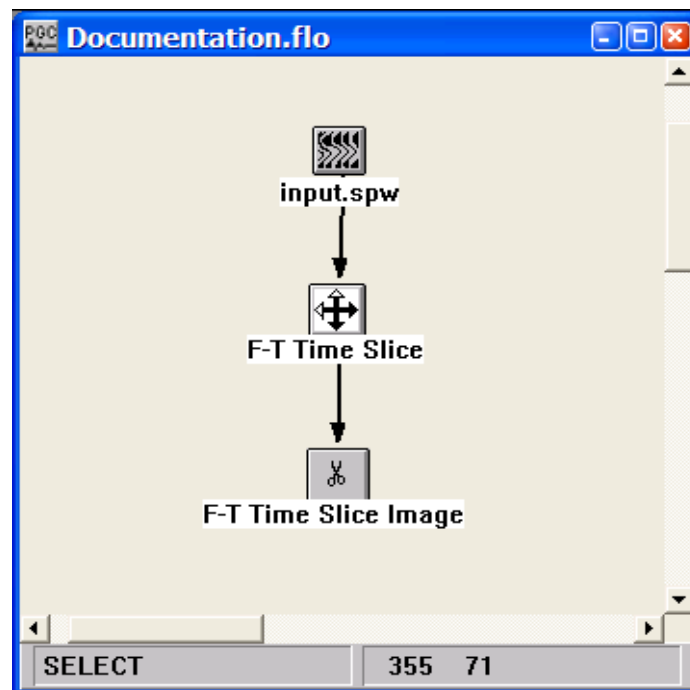
Input Links:

1) The F-T Time Slice Image receives the output from the F-T Time Slice step.

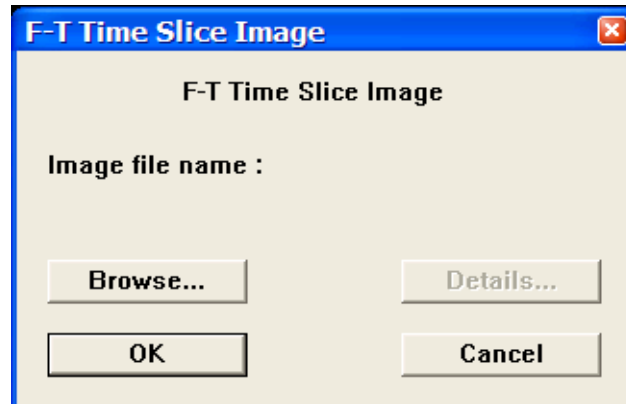
Output Links:

None – This process requires a SPW image format disk file.

Example Flowchart:



Step Parameter Dialog:



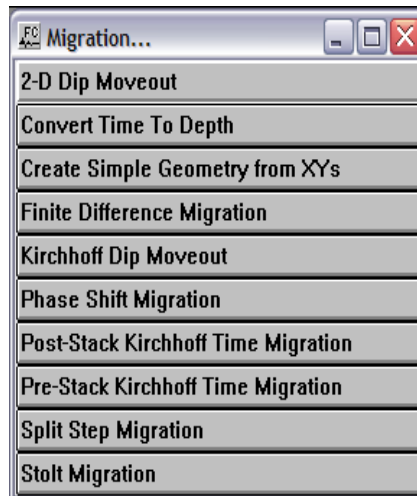
Parameter Description:

Enter the name of the Image format disk file that will contain the F-T Time Slice Image.

Migration

This section documents the processing steps available in the Migration category.

The types of migration currently available are:



2-D Dip Moveout

Usage:

Normal moveout corrections assume a layered earth. In areas of significant structure, the NMO corrections can have large residual NMO contributions. To correct for dipping structures an elliptical dip moveout summation operator can be applied to NMO corrected CMP gathers. Following the DMO correction, the CMP gathers are more properly common reflection point (CRP) gathers.

We apply an integral DMO correction as described by Yilmaz (see Yilmaz, 2001, 'Seismic Data Analysis', p.655-835). This is a summation operator applied to each source-receiver pair. There are no assumptions about regular geometry and the correction can be applied to irregularly spaced CMP gathers. This step operates on common offset gathers for calculating dip-related NMO corrections. You must enter the first time (in milliseconds) of interest for dip moveout correction. The algorithm pads the data volume on the order of four times the trace length and width for stability of the algorithm. In that regard, the later the first time of interest that you enter, the less memory needed for computations, and the faster the algorithm will complete.

Input Links:

1) Seismic data in offset order (mandatory).

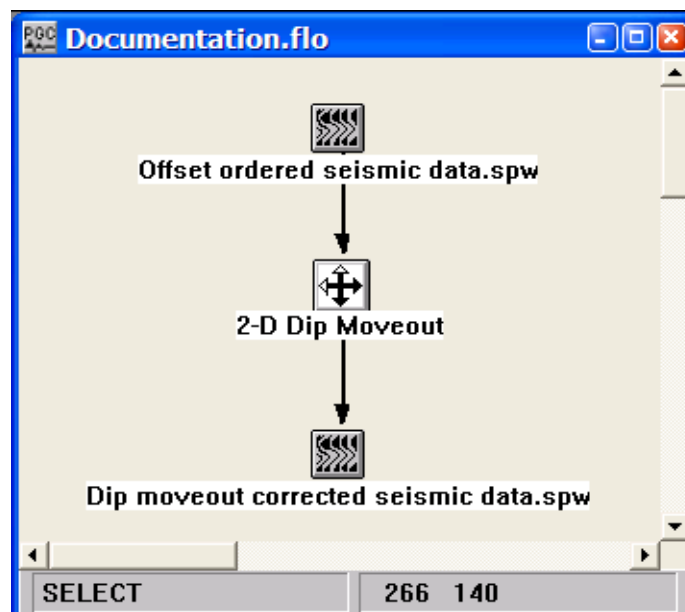
Output Links:

1) Seismic data in offset order (mandatory).

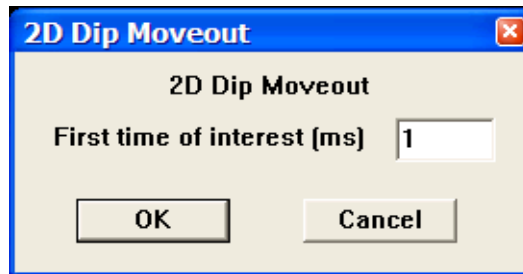
References:

Hale, D., 1984, Dip-moveout by Fourier transform, Geophysics, v. 49, no. 6, p. 741-757.
See Technical Note TN-DMO.doc

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

First time of interest (ms) — Enter the first time of interest in milliseconds. The later this time, the faster the step will run and the less memory it will use.

Create Simple Geometry from XY's

Usage:

The Create Simple Geometry from XY's step is a utility that was designed for use with the Parallel Migrations application. The step updates the trace headers of the input file with inline and crossline information based on easting and northing trace header values.

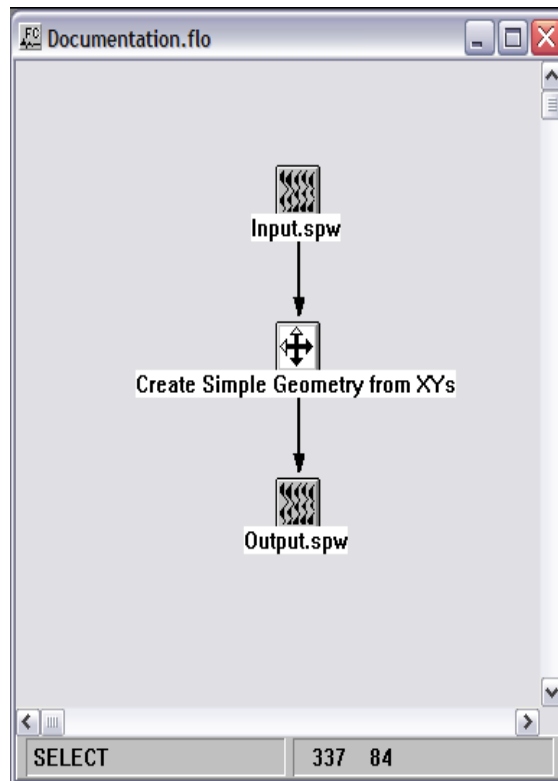
Input Links:

1) Seismic data in offset order (mandatory).

Output Links:

1) Seismic data in offset order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Create Simple Geometry from XYs

First CDP line 1

First CDP location 1.0

Easting (x) first corner 0.0

Northing (y) first corner 0.0

☒ Define 3 corners

Easting (x) second corner 0.0

Northing (y) second corner 0.0

Easting (x) third corner 0.0

Northing (y) third corner 0.0

Inline (X) interval 25.0

Crossline (Y) interval 25.0

☒ Inlines parallel to Y axis

☒ Output file is 3d

☐ Define by azimuth

Azimuth from North along Y 0.0000

☒ Survey corners define bin corners

☐ Survey corners define bin centers

OK Cancel

Parameter Description:

First CDP line —

First CDP location —

Easting (x) first corner —

Northing (y) first corner —

Easting (x) second corner —

Northing (y) second corner —

Easting (x) third corner —

Northing (y) third corner —

Inline (X) interval —

Crossline (Y) interval —

Define 3 corners –

Inlines parallel to Y axis –

Output file is 3D –

Define by azimuth –

Azimuth from north along Y-

Survey corners define bin corners –

Survey corners define bin centers –

Convert Time to Depth

Usage:

The Convert Time to Depth step does a vertical time to depth conversion of a seismic file using an input set of interval velocities. The input velocities are assumed to be in units of feet or meters per second. If the input file to be depth converted is a GPR image, and the input velocity file is in units of feet or meters per nanosecond, you must first multiply the velocity values by 1×10^{-9} .

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Velocity Function cards (optional).

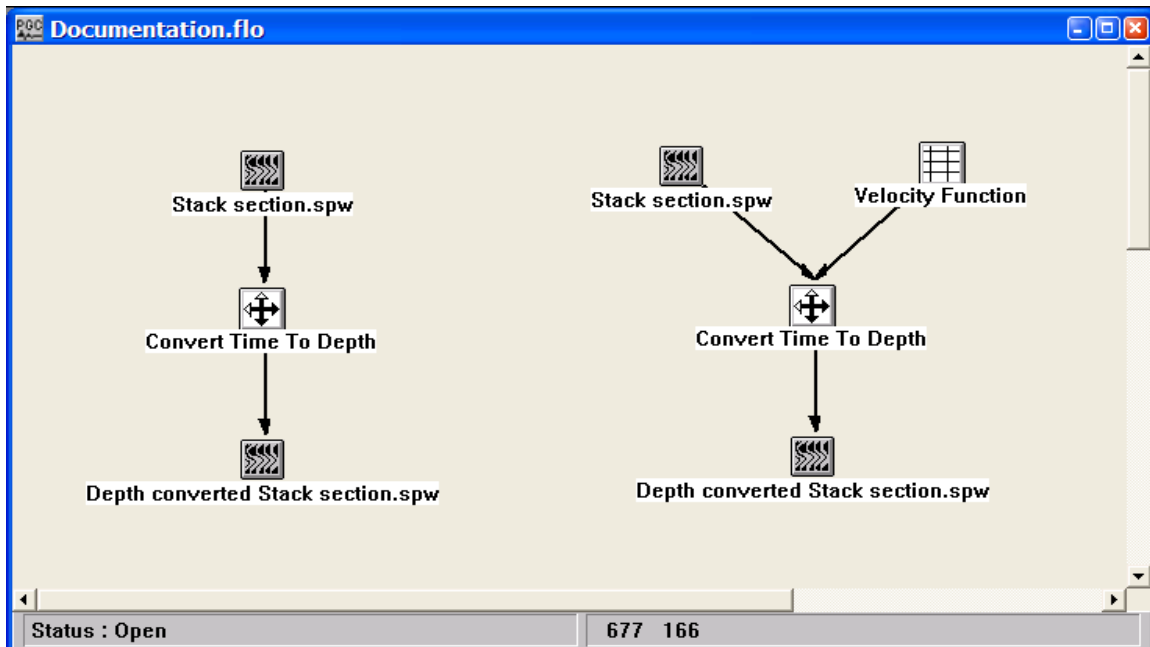
Output Links:

- 1) Seismic data in any sort order (mandatory).

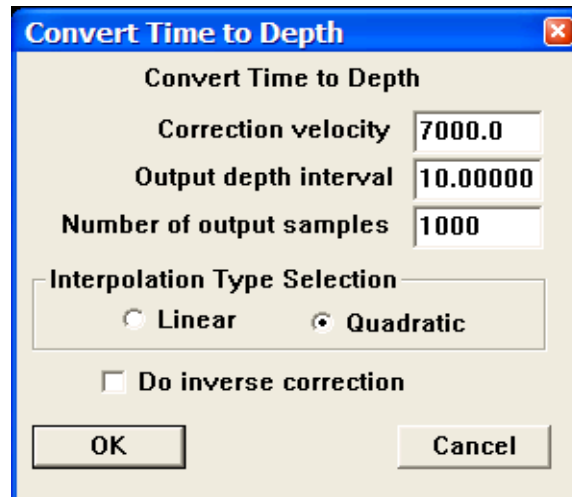
References:

See Technical Note TN-DpthConv.doc

Example Flowchart:



Step Parameter Dialog:



Convert Time to Depth

Convert Time to Depth

Correction velocity 7000.0

Output depth interval 10.00000

Number of output samples 1000

Interpolation Type Selection

☐ Linear ☒ Quadratic

☐ Do inverse correction

OK Cancel

Parameter Description:

Correction velocity — Enter the correction velocity (ft/sec or m/sec) to be used in the conversion. This constant velocity will be used unless a velocity function is connected to the step. In the case of GPR data, convert this value to the appropriate units.

Output depth interval — Enter the depth interval in your spatial units. To obtain an estimate of the output depth interval, first employ the formula $X = VT$, where X = estimated depth of section, V = average velocity of section, and T = one-way time of the section (i.e. record length divided by two). Second, employ the formula output depth interval = $\Delta X = X/(\text{number of samples} - 1)$.

Number of output samples — Enter the number of samples to output.

Interpolation Type Selection — Select the type of interpolator to use. This interpolator is used to resample the data to the specified depth interval.

Do inverse correction — If checked, a depth to time conversion will be performed.

Finite Difference Migration

2-D only

Usage:

The Finite Difference Migration step implements a variable velocity post-stack depth migration based on a finite-difference approximation of the scalar wave equation. The finite difference migration scheme accommodates a vertically and laterally varying velocity field that is supplied with an SPW velocity function card. You specify the depth sampling interval, the total number of depth samples to output, and the migration aperture in degrees of dip from 45 – 90 degrees. The computation time of the algorithm increases as a function of increased aperture. The velocity field may be adjusted by a scalar value to compensate for the fact that the supplied interval velocities may have been derived using Dix's equation, and are not true interval velocities. Finally, you can override the SPW calculated trace spacing and specify the true trace spacing of your data in your spatial units of choice. SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (mandatory).

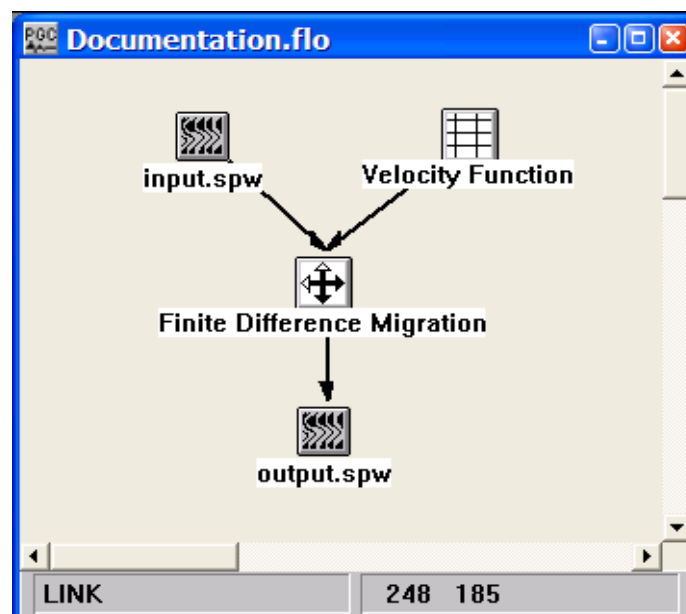
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in depth.

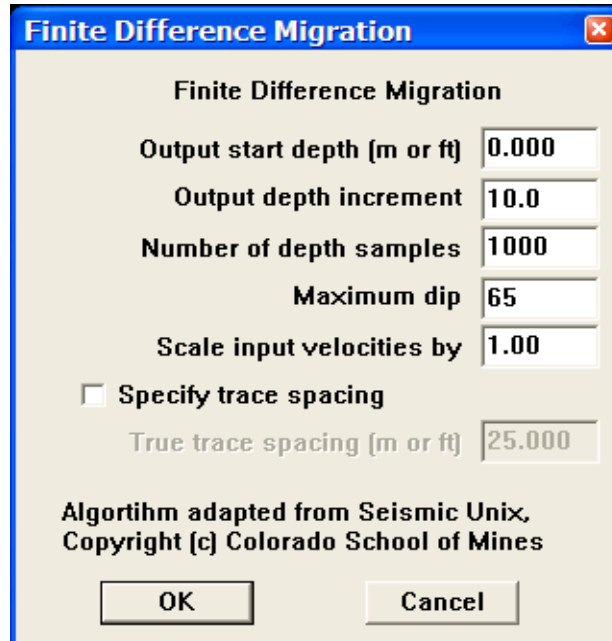
Reference:

Claerbout, J.F, 1985, Imaging the earth's interior, Blackwell Scientific Publications.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Finite Difference Migration". It contains several input fields and a checkbox. The fields are: "Output start depth (m or ft)" with value 0.000, "Output depth increment" with value 10.0, "Number of depth samples" with value 1000, "Maximum dip" with value 65, and "Scale input velocities by" with value 1.00. There is a checkbox labeled "Specify trace spacing" which is currently unchecked. Below the checkbox is a field for "True trace spacing (m or ft)" with value 25.000. At the bottom, there is a copyright notice: "Algorithm adapted from Seismic Unix, Copyright (c) Colorado School of Mines". At the very bottom are "OK" and "Cancel" buttons.

Finite Difference Migration	
Output start depth (m or ft)	0.000
Output depth increment	10.0
Number of depth samples	1000
Maximum dip	65
Scale input velocities by	1.00
<input type="checkbox"/> Specify trace spacing	
True trace spacing (m or ft)	25.000
Algorithm adapted from Seismic Unix, Copyright (c) Colorado School of Mines	
OK	Cancel

Parameter Description:

Output start depth (m or ft) — Enter the starting depth for migration.

Output depth increment (tau) — Depth sampling interval.

Number of depth samples — Total number of output depth samples.

Maximum dip — Maximum dip of migration operator in degrees

Scale input velocities by — Input velocities will be multiplied by this number. This scalar is used for adjusting the input velocities in the case that they were derived using Dix's equation, and are not true interval velocities.

Specify trace spacing — If checked, allows for manual specification of the trace spacing. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Kirchhoff Dip Moveout

Usage:

Normal moveout corrections assume a horizontally layered earth. In areas of significant structure, the NMO corrections can have large residual NMO contributions. To correct for dipping structures an elliptical dip moveout summation operator can be applied to NMO corrected CMP gathers. Following the DMO correction, the CMP gathers are more properly common reflection point (CRP) gathers.

We apply an integral DMO correction as described by Yilmaz (see Yilmaz, 2001, 'Seismic Data Analysis', p.655-835). This is a summation operator applied to each source-receiver pair. There are no assumptions about regular geometry and the correction can be applied to irregularly spaced CMP gathers. The summation operator is applied at a user-specified number of evenly spaced offsets located along an axis connecting the source and receiver. These DMO corrected traces are then summed at each bin location.

For 3D datasets, the summation at each bin can cause the resulting gathers to be spatially aliased. To avoid aliasing, a 2D sinc interpolator with an apodizing Hanning filter is applied to spatially smooth the DMO corrected traces.

Input Links:

- 1) Seismic data in any sort order (mandatory).

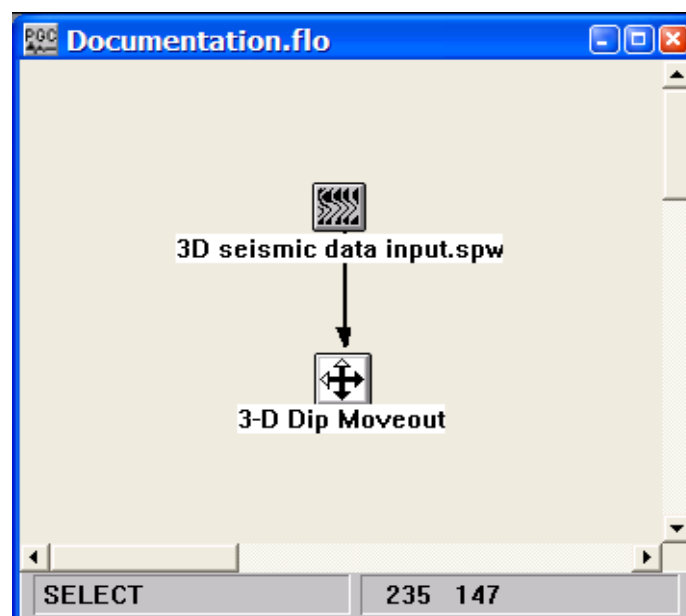
Output Links:

- 1) None. The DMO corrected data are output to an auxiliary disc file.

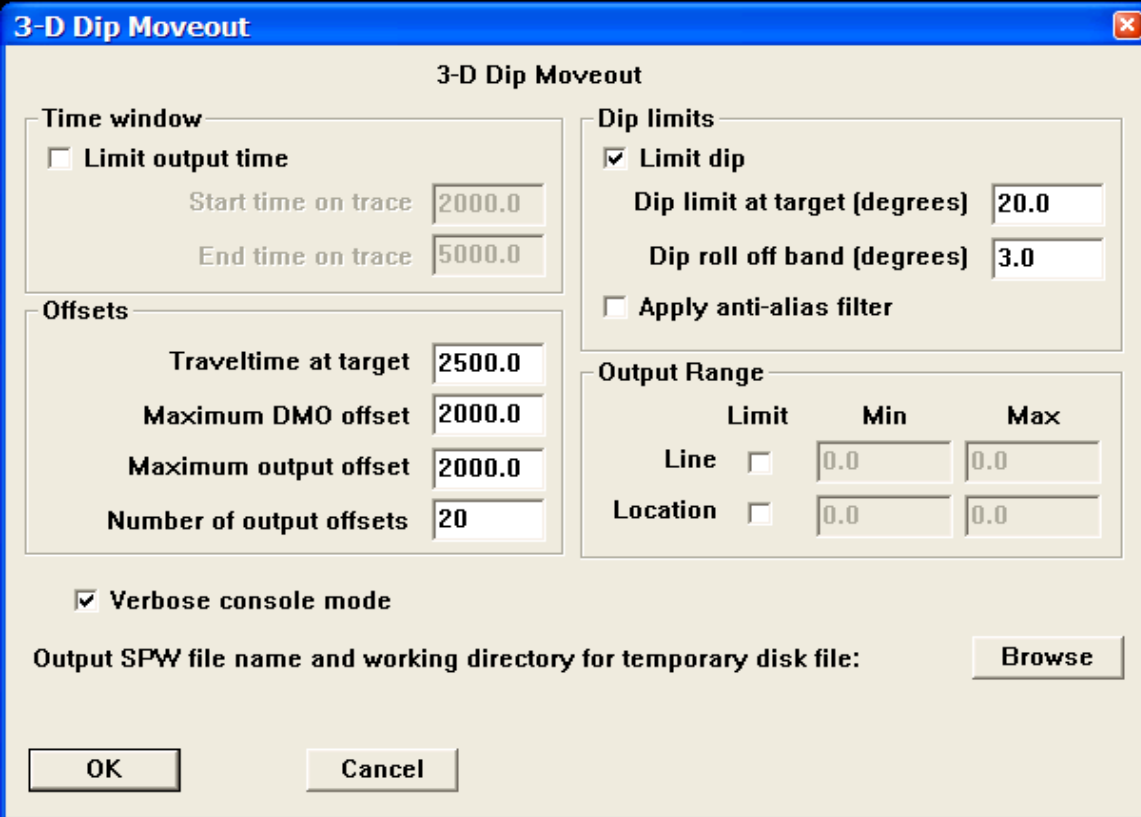
Reference:

See Technical Note TN-DMO.doc

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "3-D Dip Moveout" and contains several sections for parameter configuration:

- Time window**: Includes a checkbox for "Limit output time". If checked, it shows input fields for "Start time on trace" (2000.0) and "End time on trace" (5000.0).
- Offsets**: Includes input fields for "Traveltime at target" (2500.0), "Maximum DMO offset" (2000.0), "Maximum output offset" (2000.0), and "Number of output offsets" (20).
- Dip limits**: Includes a checked checkbox for "Limit dip", with input fields for "Dip limit at target (degrees)" (20.0) and "Dip roll off band (degrees)" (3.0). It also has an unchecked checkbox for "Apply anti-alias filter".
- Output Range**: A table with columns "Limit", "Min", and "Max". It has two rows: "Line" and "Location", each with an unchecked checkbox and input fields for "Min" (0.0) and "Max" (0.0).
- Verbose console mode**: A checked checkbox.
- Output SPW file name and working directory for temporary disk file:** A text field with a "Browse" button.
- Buttons**: "OK" and "Cancel" buttons at the bottom.

Parameter Description:

Time window — The output time may be limited to decrease the run time and the amount of memory required for execution.

Start time on trace – Enter the start time for DMO correction in msecs.

End time on trace – Enter the end time for DMO correction in msecs.

Offsets — Determine the range of offsets output by the 3D DMO algorithm.

Traveltime at target – Estimated travel time of target event. This time is used to estimate candidate CMP bins for the DMO correction.

Maximum DMO offset – The maximum offset from the source-receiver mid-point to apply the DMO correction. Typically, this number should be no larger than 10 times the CMP bin spacing.

Maximum output offset – The maximum source-receiver offset for the output DMO corrected gathers.

Number of output offset – Enter the number of output offsets (Maximum output offset/Number of output offsets) is the output DMO offset spacing.

Dip Limits — The maximum allowable DMO operator dip in degrees. Limiting the aperture of the DMO operator will decrease the run time and the amount of memory required for execution.

Dip limit at target – Enter the number of degrees of aperture in the DMO impulse response at the target time.

Dip rolloff band – Taper length in degrees of aperture over which the DMO impulse response is tapered to zero.

Apply anti-alias filter – If checked, applies a 2D sinc interpolator with an apodizing Hanning filter to reduce spatial aliasing of high frequency components of the DMO operator.

Output range – Allows control of the spatial range of DMO corrected output data.

Line – If checked, allows you to limit the range of CMP lines output by the algorithm.

Min – Minimum CMP line number to output.

Max – Maximum CMP line number to output.

Location – If checked, allows you to limit the range of CMP locations output by the algorithm.

Min – Minimum CMP location number to output.

Max – Maximum CMP location number to output.

Output SPW file name and working directory for temporary disk file – The Browse button allows selection of the DMO corrected output data volume.

Phase Shift Migration

2-D only

Usage:

The Phase Shift Migration step implements a constant velocity or a depth-variable velocity post stack phase shift time migration in the frequency domain. The input velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data.

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (optional).

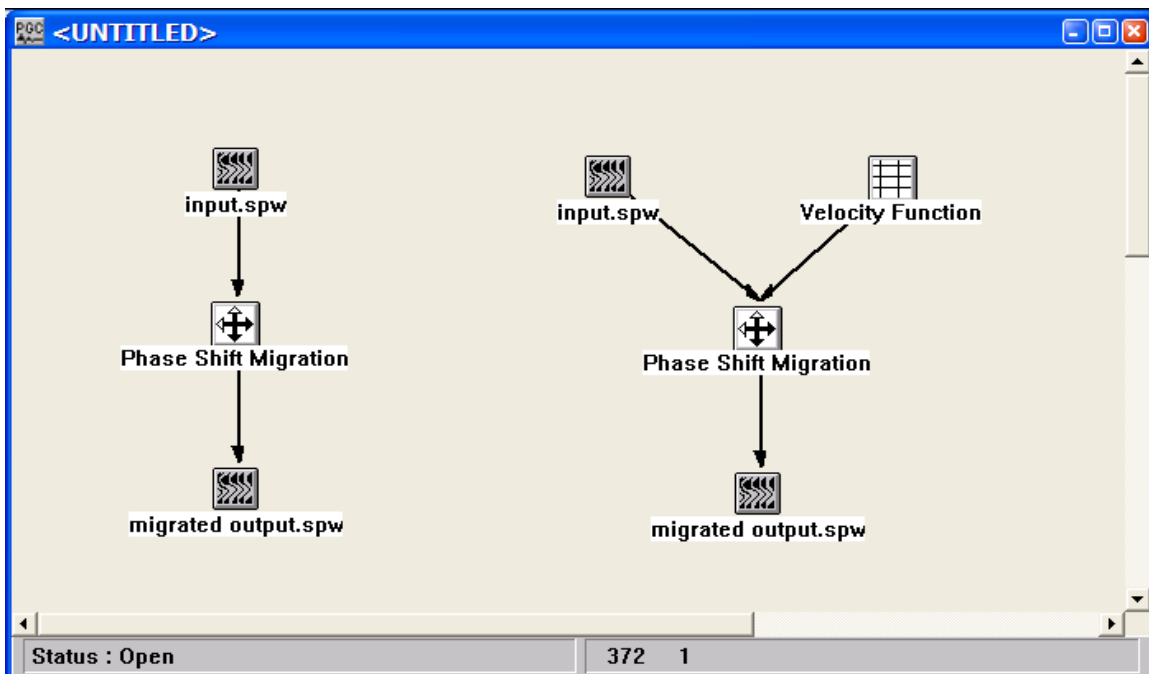
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in time.

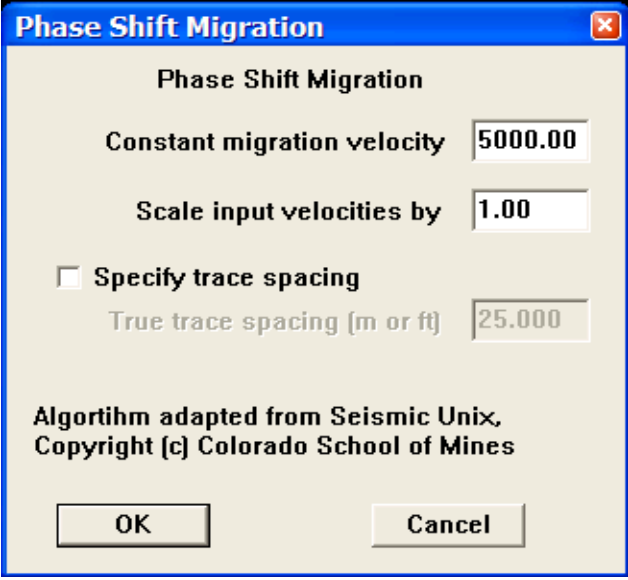
Reference:

Gazdag, J, 1978, Wave-equation migration by phase shift, Geophysics, v. 43, p. 1342-1351.

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Phase Shift Migration". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. At the top, the title "Phase Shift Migration" is repeated. Below it, there are three input fields: "Constant migration velocity" with a value of 5000.00, "Scale input velocities by" with a value of 1.00, and "Specify trace spacing" which is unchecked. Below the checkbox is a label "True trace spacing (m or ft)" and a corresponding input field with a value of 25.000. At the bottom, there is a copyright notice: "Algorithm adapted from Seismic Unix, Copyright (c) Colorado School of Mines". At the very bottom are two buttons: "OK" and "Cancel".

Parameter	Value
Constant migration velocity	5000.00
Scale input velocities by	1.00
Specify trace spacing	<input type="checkbox"/>
True trace spacing (m or ft)	25.000

Algorithm adapted from Seismic Unix,
Copyright (c) Colorado School of Mines

OK Cancel

Parameter Description:

Constant migration velocity — This constant velocity value will be used as the migration velocity if no velocity cards are linked.

Scale input velocities by — The input velocities are multiplied by this number. This scalar is used for adjusting the input velocities if they are interval velocities derived using Dix's equation rather than true interval velocities.

Specify trace spacing — If checked, allows for manual specification of the trace spacing. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Post-Stack Kirchhoff Time Migration

Usage:

The Post-Stack Kirchhoff Time Migration implements a diffraction summation migration of the Kirchhoff type that is capable of handling vertically and laterally varying velocity fields. The input velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data.

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (mandatory).

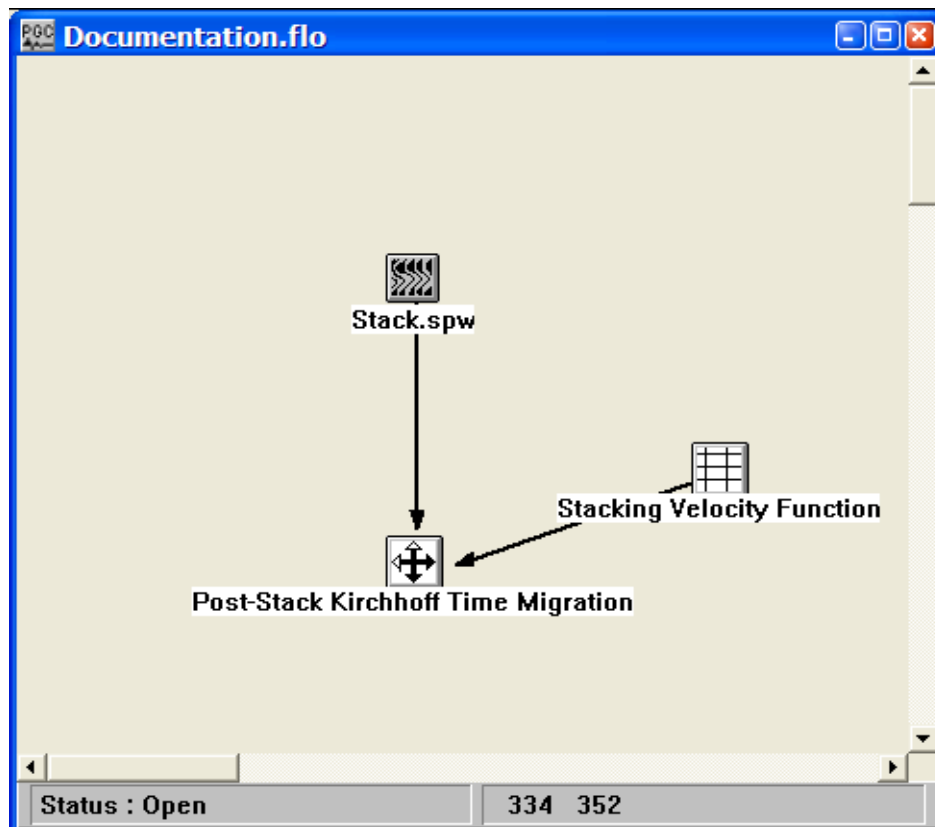
Output Links:

- 1) None. The migrated section is output to an auxiliary disc file.

Reference:

Schneider, W. A., 1976, Integral formulation for migration in two and three dimensions, Geophysics, 43, p. 49-76.

Example Flowchart:



Step Parameter Dialog:

Post-Stack Kirchhoff Time Migration

Time window

☐ Limit output time

Start time on trace 2000.0

End time on trace 5000.0

Dip limits

☒ Limit dip

Dip limit at target (degrees) 45.0

Dip roll off band (degrees) 5.0

Target

Traveltime at target 4000.0

Velocity at target 2450.0

Anti-alias filter

☒ Apply anti-alias filter

Maximum frequency 60.0

Output Range

	Limit	Min	Max
Line	<input checked="" type="checkbox"/>	105.0	105.0
Location	<input checked="" type="checkbox"/>	50.5	990.5

Output SPW file name and working directory for temporary disk file:

BP-105 45degOp 100% Vel Migration.spw

Parameter Description:

Time window — The output time may be limited to decrease the run time and the amount of memory required for execution.

Limit output time – If checked, the output time of the migration will be limited

Start time on trace – Enter the start time for migration in milliseconds.

End time on trace – Enter the end time for migration in milliseconds.

Target

Traveltime at target – Estimated travel time of target event. This time is used to set the migration aperture.

Velocity at target – Estimated velocity of target event. This velocity is used to set the migration aperture.

Output range – Allows control of the spatial range of migrated output data.

Line – If checked, allows you to limit the range of CMP lines output by the algorithm.

Min – Minimum CMP line number to output.

Max – Maximum CMP line number to output.

Location – If checked, allows you to limit the range of CMP locations output by the algorithm.

Min – Minimum CMP location number to output.

Max – Maximum CMP location number to output.

Dip Limits — The maximum allowable migration aperture in degrees of dip. Limiting the aperture of the migration operator will decrease the run time and the amount of memory required for execution.

Dip limit at target – Enter the number of degrees of aperture in the migration impulse response at the target time.

Dip rolloff band – Taper length in degrees of aperture over which the migration impulse response is tapered to zero.

Apply anti-alias filter – If checked, applies a filter to reduce spatial aliasing of high frequency components of the migration operator.

Migrate from surface topography – If checked, the migration will be performed from the surface elevations stored in the trace header. If not check, the migration step will assume that the stack has been previously static corrected to a flat reference datum.

Output SPW file name and working directory for temporary disk file – The Browse button allows selection of the migrated output data volume.

Pre-Stack Kirchhoff Time Migration

Usage:

The Pre-Stack Kirchhoff Time Migration implements a diffraction summation migration of the Kirchhoff type on a pre-stack data volume that is capable of handling vertically and laterally varying velocity fields.

Introduction

Pre-stack Time Migration is a compute intensive process. The length of the processing run is proportional to the migration aperture size and the size of the input seismic volume. By partitioning the output data volume to fit within system memory limits, the migration run time can be optimized.

The Kirchhoff Pre-stack Time Migration follows the traditional SPW processing flow and migrates a single CMP gather at a time. Large migration apertures can result in a single CMP gather trace being migrated to a large number of output migration bins. As a result, in addition to the disk space required to hold the input dataset, the migration also requires a working data store. Proper sizing of the working dataset size can greatly improve the processing speed of the migration.

The migration requires a working data store size that is approximately equivalent to the size of the output data volume. This size is equal to the number of output bins times the number of output offsets times the number of output samples times 4 in bytes. The 'Minimum virtual memory size' printed during the initial phase of the migration is the amount of memory required for the data store. If the amount of real or virtual memory available is not greater than this value, the migration creates a disk file to use for the data store. Disk input/output is substantially slower than memory input/output. As such, the best performance occurs when the data store can reside in memory.

For modest 3d data volume sizes, the working file can be large. In the event that the working file size is greater than available memory, best performance is obtained by partitioning the output data volume and merging the resultant migrations once they have completed. Tape Utility provides a convenient option for the merging process.

The partitioning process identifies all the input traces that are candidates for contributing to a given set of migration bins and creates an input data volume from the candidate CMP gathers. For large apertures, these data volumes can overlap.

Partitioning

1. Identify available real or virtual memory.

For Windows see Help: Managing Computer Memory: Virtual Memory or Pagefile

For Linux see ManPages: Swapfile

2. Divide available memory in bytes by the number of output samples * the number of output offsets * 4. This is the number of output bins that can fit into memory.
3. Determine the number of complete inlines that can fit within this number of bins.
4. Allow a little margin.
5. The partition size is the subset number of inlines by the number of cross lines.
6. Use the PreStack Kirchhoff Data Input processing flow to generate input volumes for the partitioned data set.
7. Migrate each partition separately.
8. Use Tape Utility SPW File Merge to collate the output volume from each of the partitions.

Monitoring

Migration times can be lengthy depending on the migration aperture and the input seismic volume size. The migration process generates quality control (QC) files for evaluation during the migration.

QC files are generated at a user specified line interval. The output QC CMP gathers correspond to the gathers for a partial migration of the last completed inline of input CMP records. The line number is printed to the console screen for reference. Since the full migration is not complete until all records within the migration aperture have been migrated, the purpose of the QC file is to monitor the migration for amplitude spikes, dead traces and overall data character. The QC file can be found in the spwQC subdirectory located in the same directory as the input data volume.

A checkpoint file is saved to disk at the same time the QC file is created. Checkpoints occur at the same interval specified for the QC files. In the event that a migration needs to be restarted, check the console file for the input record number that corresponds with the last saved checkpoint file. In the Flowchart processing flow for Kirchhoff Pre-Stack Time Migration, check the restart box and specify the starting record number. Compile the processing flow and restart the migration.

Directory setup

Refer to the SPW INSTALL notes for a description of the initial directory configuration. Distributed processing requires master and slave executables to reside in the SPWHOME and the SLAVEHOME directories respectively. The input dataset can reside anywhere on the master platform.

The user is responsible for creating a QC directory and a checkpoint directory. The QC directory should reside in the same directory as the input seismic volume and it should be named spwQC. If the directory does not exist, the user will receive a message during the migration start up and the migration will stop.

The checkpoint directory is not required but highly recommended. This directory needs to reside in the same directory as the migration slave executable excslv and should be named spwdata. There should be enough disk space to hold a checkpoint file that is the number of bins times the number of offsets times the number of output time samples times 4 in bytes.

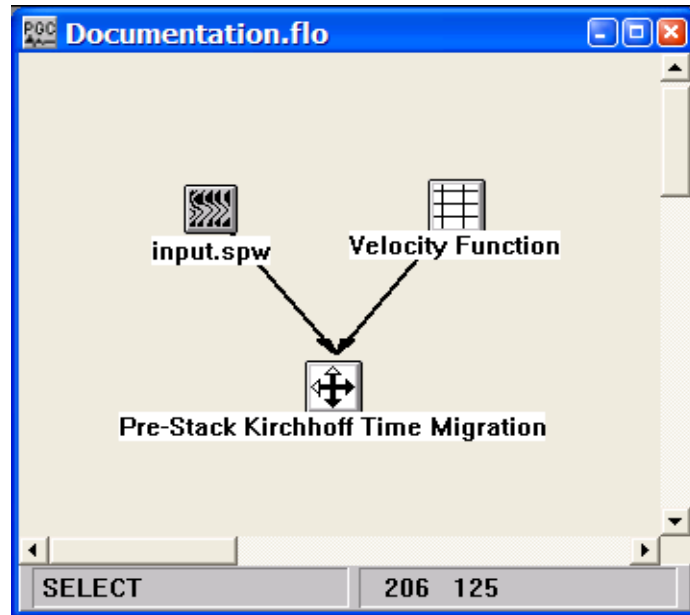
Input Links:

- 1) Seismic data in bin sorted order (mandatory).
- 2) Velocity Function cards (mandatory).

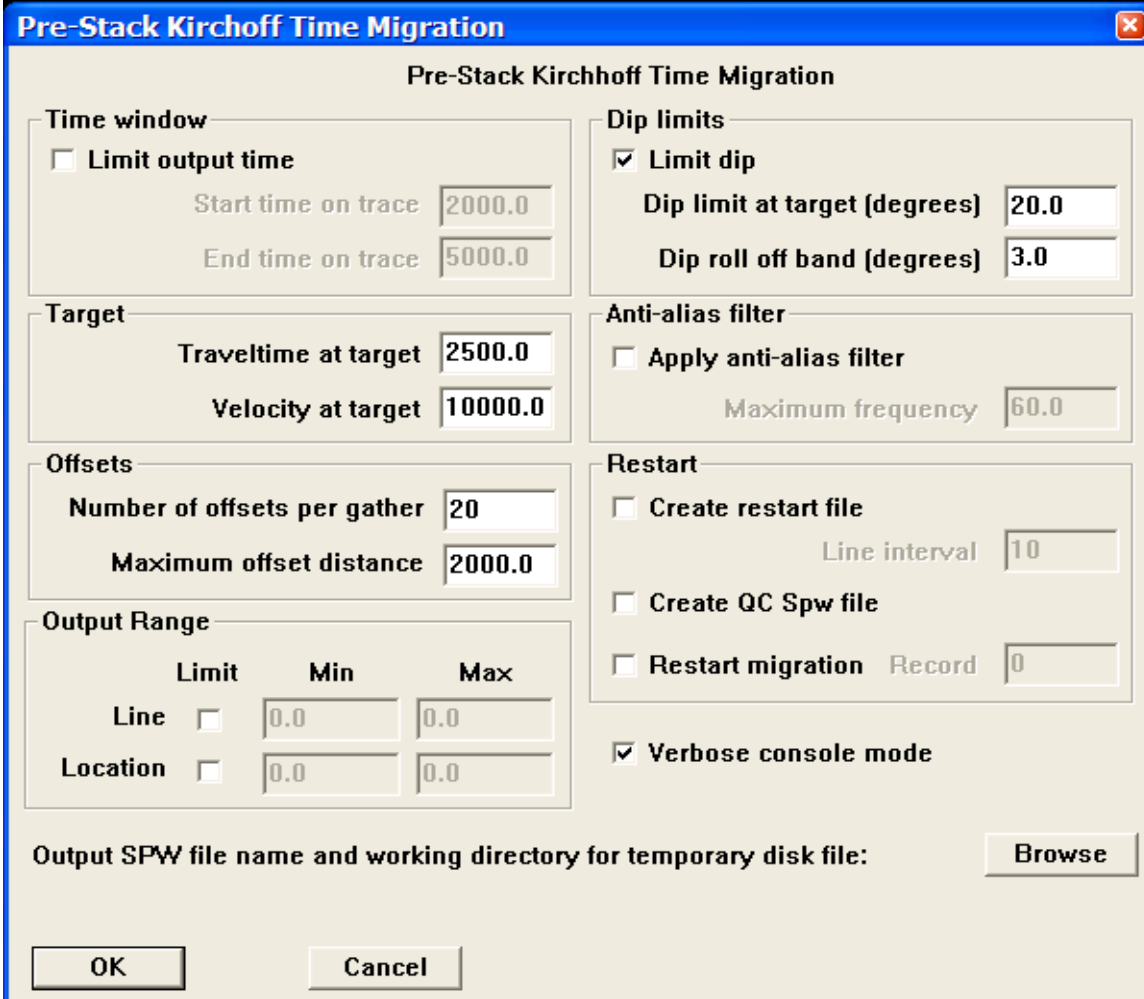
Output Links:

- 1) None. The migrated data is output to an auxiliary disc file.

Reference:**Example Flowchart:**



Step Parameter Dialog:



The dialog box is titled "Pre-Stack Kirchhoff Time Migration". It contains several sections for parameter configuration:

- Time window**: Includes a checkbox for "Limit output time". If checked, it shows "Start time on trace" (2000.0) and "End time on trace" (5000.0).
- Dip limits**: Includes a checked checkbox for "Limit dip". It shows "Dip limit at target (degrees)" (20.0) and "Dip roll off band (degrees)" (3.0).
- Target**: Shows "Traveltime at target" (2500.0) and "Velocity at target" (10000.0).
- Anti-alias filter**: Includes a checkbox for "Apply anti-alias filter". If checked, it shows "Maximum frequency" (60.0).
- Offsets**: Shows "Number of offsets per gather" (20) and "Maximum offset distance" (2000.0).
- Restart**: Includes checkboxes for "Create restart file", "Create QC Spw file", and "Restart migration". It also shows "Line interval" (10) and "Record" (0). A checked checkbox for "Verbose console mode" is also present.
- Output Range**: A table with columns "Limit", "Min", and "Max". It has rows for "Line" and "Location", each with a checkbox and input fields.
- Output SPW file name and working directory for temporary disk file:** A text field with a "Browse" button.
- Buttons**: "OK" and "Cancel" buttons at the bottom.

	Limit	Min	Max
Line	<input type="checkbox"/>	0.0	0.0
Location	<input type="checkbox"/>	0.0	0.0

Parameter Description:

Time window — The output time may be limited to decrease the run time and the amount of memory required for execution.

Limit output time – If checked, the output time of the migration will be limited by the following parameters:

Start time on trace – Enter the start time for migration in milliseconds.

End time on trace – Enter the end time for migration in milliseconds.

Target – Allows the migration operator to be customized to the target time and velocity.

Traveltime at target – Two-way traveltime in milliseconds to the target event. This time is used to determine candidate bins in the migration aperture.

Velocity at target – Estimated velocity at the target event.

Offsets – The offset menu controls the range and number of the pre-stack migrated traces per bin according to the following parameters:

Number of offsets per gather – Enter the number of output pre-stack migrated offsets per bin.

Maximum offset distance – Enter the maximum offset distance to migrate. The offset interval of output traces in each bin will be (max. offset distance / # of offsets).

Output range – The Output range menu controls of the spatial range of pre-stack migrated data. The partitioning process identifies all the input traces that are candidates for contributing to the specified range of migration bins and creates an input data volume from the candidate CMP gathers.

Line – If checked, allows you to limit the range of CMP lines output by the algorithm.

Min – Minimum CMP line number to output.

Max – Maximum CMP line number to output.

Location – If checked, allows you to limit the range of CMP locations output by the algorithm.

Min – Minimum CMP location number to output.

Max – Maximum CMP location number to output.

Dip Limits — The Dip Limits menu controls the maximum dip of the migration operator in degrees. Limiting the aperture of the migration operator will decrease the run time and the amount of memory required for execution.

Limit dips – If checked, the maximum dip of the migration operator is limited by the following parameters:

Dip limit at target – Enter the number of degrees of aperture in the Migration impulse response at the target time.

Dip rolloff band – Taper length in degrees of aperture over which the Migration impulse response is tapered to zero.

Anti-alias filter – The summation of high temporal frequencies at each bin in 3D and at each CMP in irregularly sampled 2D data are prone to spatial aliasing. To avoid

aliasing, a 2D sinc interpolator with an apodizing Hanning filter is applied to spatially smooth the migrated traces.

Apply anti-alias filter – If checked, applies a filter to reduce spatial aliasing of high frequency components of the migration operator.

Maximum frequency – Enter the maximum frequency of the migration operator.

Restart – In the case of system failure during migration, the following parameters allow the migration to be restarted from a point closely preceding the failure.

Create restart file – If checked, checkpoint files will be created during the migration to minimize data loss in the event of a system failure.

Line interval – Line interval to write restart and QC files. The writing of restart and QC files can be time consuming. Therefore, this option should only be used for prolonged migration runs (>3days).

Create QC SPW file – If checked, QC files will be generated at the user specified line intervals. The output QC CMP gathers correspond to the gathers for a partial migration of the last completed inline of input CMP records, and can be used to monitor the quality of the migration. It is recommended to create QC files during initial testing.

Restart migration – If checked, the migration is of a restart file and is restarted from the last checkpoint.

Record – Checks the console file for the input record number that corresponds with the last saved checkpoint file. The migration can be restarted from this point.

Verbose console mode – If checked, allows for the user to view a running summary of migrated traces and aperture bins.

Output SPW file name and working directory for temporary disk file – The Browse button allows selection of the migrated output data volume file name.

Split-Step Migration

2-D only

Usage:

The Split-Step Migration step implements a split-step frequency domain depth migration of post-stack data. The input velocity field is assumed to be an interval velocity field that was derived from the stacking velocity field via Dix Equation.

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (mandatory).

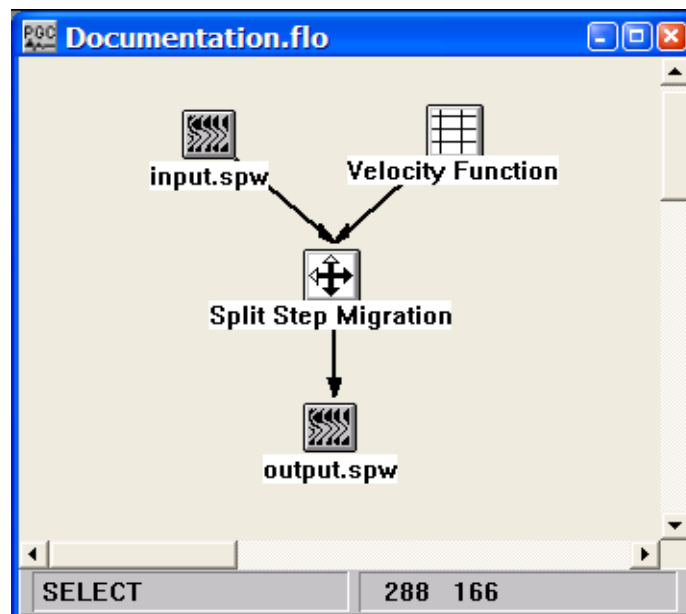
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in depth.

Reference:

Stoffa, P. L., Fokkema, J. T., Freire, R. M. and Kessinger, W. P., 1990, Split-step Fourier migration, Geophysics, 55, 410-421.

Example Flowchart:



Step Parameter Dialog:

Split Step Migration

Output start depth (m or ft) 0.000

Output depth increment 10.0

Number of depth samples 1000

Scale input velocities by 1.00

☐ Specify trace spacing

True trace spacing (m or ft) 25.000

Algorithm adapted from Seismic Unix,
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OK Cancel

Parameter Description:

Output start depth (m or ft) — Enter the starting depth for migration.

Output depth increment (tau) — Depth sampling interval.

Number of depth samples — Total number of output depth samples.

Scale input velocities by — Input velocities will be multiplied by this number. This scalar is used for adjusting the input velocities in the case that they were derived using Dix's equation, and are not true interval velocities.

Specify trace spacing — If checked, allows for manual specification of the trace spacing. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Stolt Migration

2-D only

Usage:

The Stolt Migration step implements a constant velocity or depth variable Stolt migration algorithm for post-stack time migration. This migration scheme can accommodate a vertically varying velocity field in the form of one SPW velocity function card. This velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data. The user designates a Stolt stretch factor, a maximum frequency to migrate, and temporal and spatial tapers. An option allows the input velocity function to be scaled. Finally, you can override the SPW calculated trace spacing and specify the true trace spacing of your data in your spatial units of choice. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (optional).

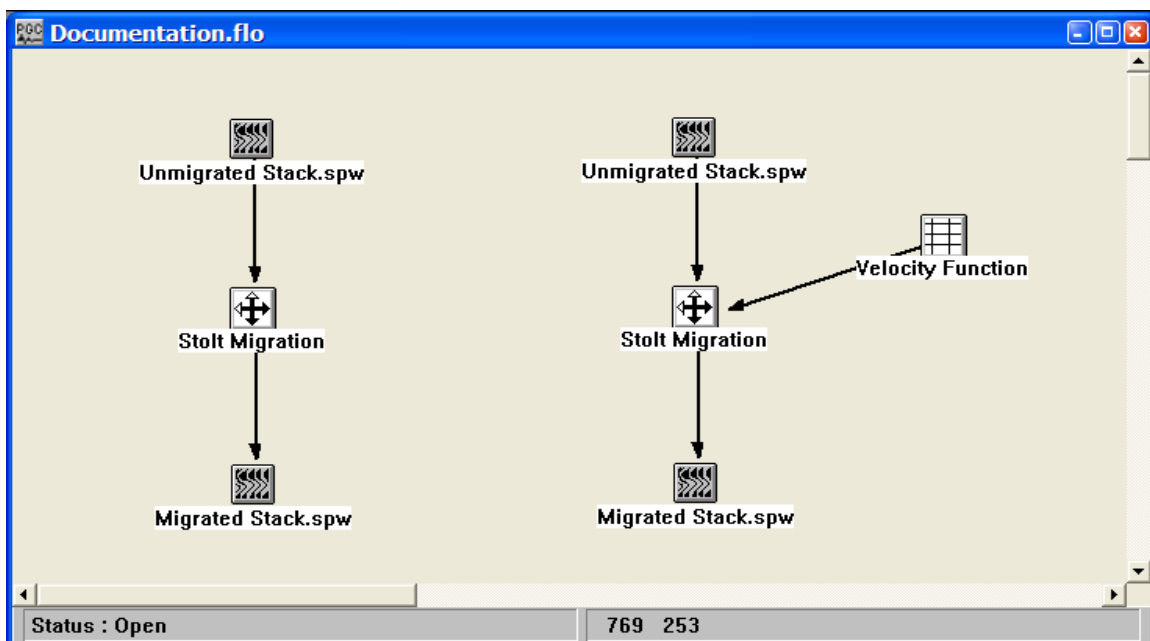
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in time.

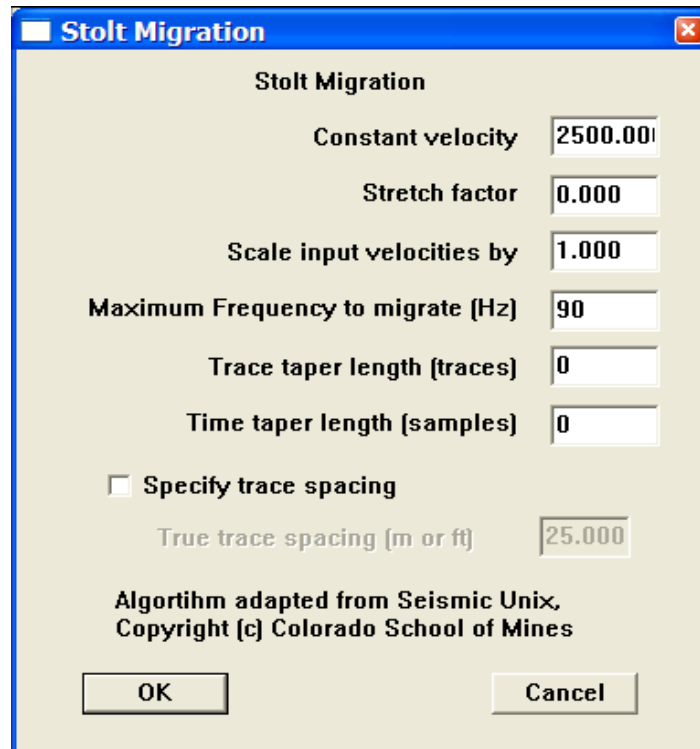
Reference:

Stolt, R.H, 1978, Migration by Fourier transform, Geophysics, v. 43, no 1., p. 23-48.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Stolt Migration". It contains several input fields and a checkbox. The fields are: "Constant velocity" with a value of 2500.00, "Stretch factor" with a value of 0.000, "Scale input velocities by" with a value of 1.000, "Maximum Frequency to migrate (Hz)" with a value of 90, "Trace taper length (traces)" with a value of 0, and "Time taper length (samples)" with a value of 0. There is a checkbox labeled "Specify trace spacing" which is currently unchecked. Below this checkbox is a field for "True trace spacing (m or ft)" with a value of 25.000. At the bottom of the dialog, there is a copyright notice: "Algorithm adapted from Seismic Unix, Copyright (c) Colorado School of Mines". There are "OK" and "Cancel" buttons at the bottom.

Parameter	Value
Constant velocity	2500.00
Stretch factor	0.000
Scale input velocities by	1.000
Maximum Frequency to migrate (Hz)	90
Trace taper length (traces)	0
Time taper length (samples)	0
Specify trace spacing	<input type="checkbox"/>
True trace spacing (m or ft)	25.000

Algorithm adapted from Seismic Unix,
Copyright (c) Colorado School of Mines

OK Cancel

Parameter Description:

Constant velocity — Enter an "average" velocity for the entire stack. This velocity will be used as the constant migration velocity if no velocity cards are linked.

Stretch factor — In the case of a time-variable velocity field, the Stolt stretch factor is designed to stretch the time axis so that the data appear to have propagated through a constant-velocity earth. Values of 0.5 to 1 are typical.

Scale input velocities by — The input velocities are multiplied by this number. This scalar may be used for adjusting the input velocities if they are interval velocities derived using Dix's equation rather than true interval velocities.

Maximum frequency to migrate — Enter the maximum frequency component in the data to be migrated.

Trace taper length (traces)— Number of traces to over which to taper traces at the start and end of the line prior to migration.

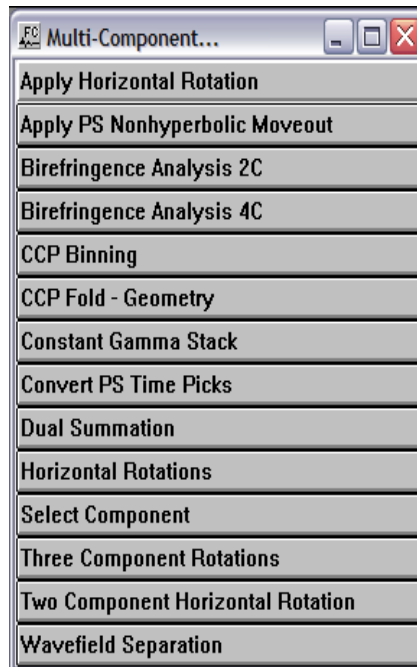
Time taper length (samples) — Number of samples to over which to taper at the start and end of each trace prior to migration.

Specify trace spacing — If checked, allows for manual specification of the trace spacing. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Multi-Component

This section documents the processing steps available in the Multi-Component category.

The multi-component processing steps currently available are:



Note on Multi-component trace header values

Receiver Type	Receiver component trace-header value
Hydrophone or pressure sensor	11
Vertical-component receiver	12
Crossline-component receiver	13
Inline component receiver	14
Rotated vertical-component receiver	15
Rotated transverse-component receiver	16
Rotated radial-component receiver	17
Summed vertical component receiver	28

Receiver types and Receiver component trace header values

Source Type	Source component trace-header value
Vertical-component source	22
Crossline-component source	23
Inline component source	24
Rotated vertical-component source	25
Rotated transverse-component source	26
Rotated radial-component source	27

Source types and Source component trace header values

Apply Horizontal Rotation

Usage:

The Apply Horizontal Rotation step rotates the horizontal components of a multi-component data volume through rotation angles determined by the Two Component Horizontal Rotation step. The rotation angles are read from a Rotation Card file. In the case of 2D data acquisition with field oriented 3C receivers, an option exists to limit the rotation angle to a user-specified range.

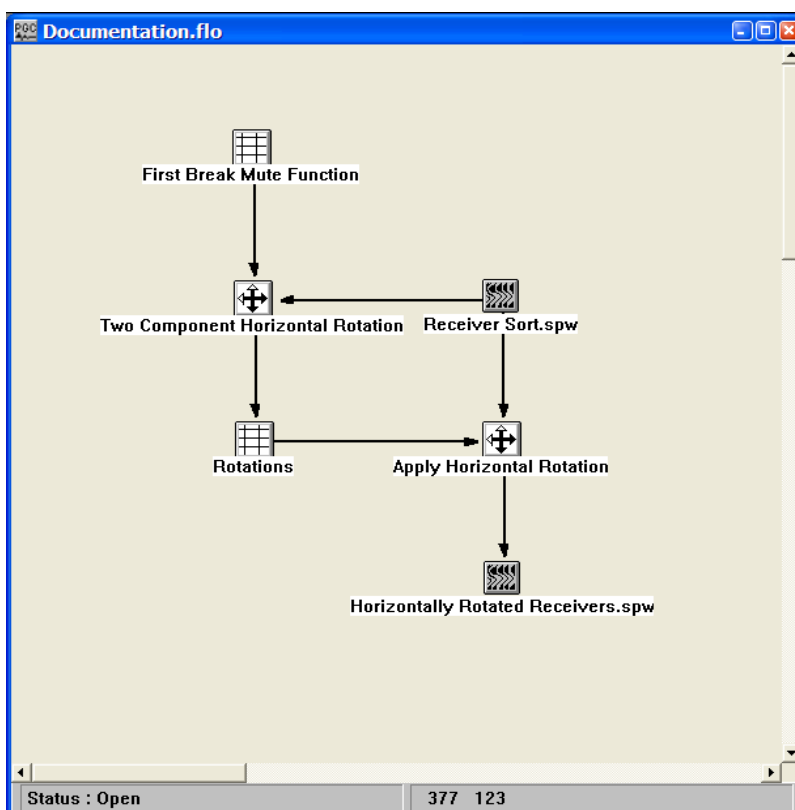
Input Links:

- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.
- 2) Rotation Card file containing the estimated rotation angles (optional).

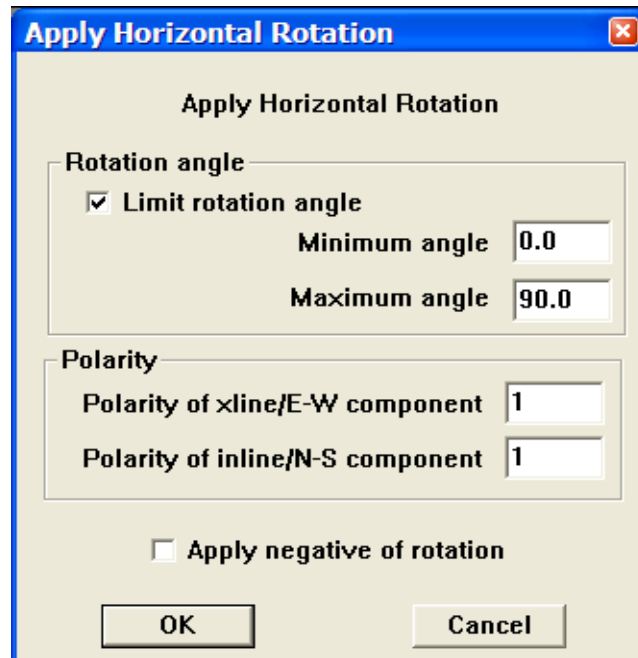
Output Links:

- 1) Seismic data in common receiver order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Apply Horizontal Rotation

Rotation angle

☒ Limit rotation angle

Minimum angle 0.0

Maximum angle 90.0

Polarity

Polarity of xline/E-W component 1

Polarity of inline/N-S component 1

☐ Apply negative of rotation

OK Cancel

Parameter Description:

Rotation angle

Limit rotation angle - If checked, the rotation angle used to rotate the horizontal components will be limited by the user-specified minimum and maximum angles.

Minimum angle – The minimum allowable rotation angle.

Maximum angle – The maximum allowable rotation angle.

Polarity

Polarity of xline/E-W component – Defines polarity of crossline component. Valid values are +/- 1.

Polarity of inline/N-S component – Defines polarity of inline component. Valid values are +/- 1.

Apply PS Non-hyperbolic Moveout

Usage:

Converted wave travel-times are not a hyperbolic function of offset. The total moveout of a converted wave reflection can be described accurately with the double square root (DSR) equation. This equation gives the complete travel time correction as a function of offset, bounce point and gamma, where gamma is defined as the ratio of compressional-wave to shear-wave velocity. The Apply PS Non-hyperbolic Moveout step uses the combination of P-wave stacking velocities and Gamma functions to correct for non-hyperbolic moveout.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) PS Nhmo Gamma Function card data file containing gamma pics (mandatory).
- 3) Velocity Function card data file containing P-wave velocity pics (optional).

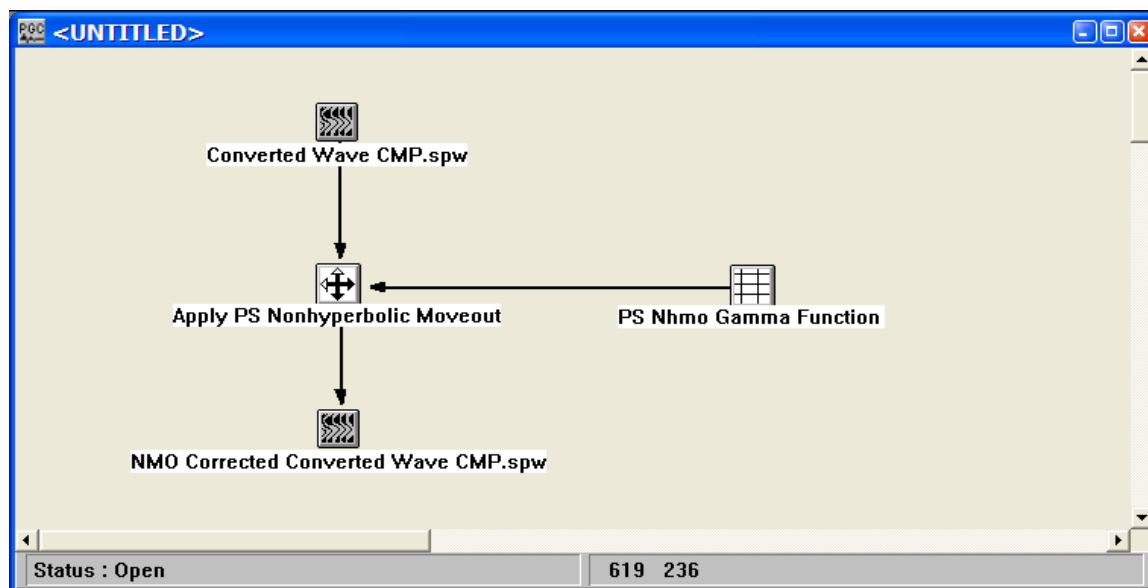
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

Yilmaz, 2001, 'Seismic Data Analysis', 2nd Ed. p.1946-1959.

Example Flowchart:



Step Parameter Dialog:

Apply PS Nonhyperbolic Moveout

Correction velocity

Interpolation Type Selection

☐ Linear ☒ Quadratic

Mute Control

☒ Apply stretch mute

Percentage

Taper length (samples)

Scale input velocities by

☐ Do inverse moveout

Input PP velocity file:

Parameter Description:

Correction velocity — Enter the P-wave NMO velocity. This constant velocity will be used if a P-wave stacking velocity function is NOT selected using the Browse button.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Mute Control — Set the parameters for the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NHMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute tape length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Scale input velocities by – Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Browse – Select the velocity card containing P-wave stacking velocities previously obtained through analysis of vertical component data.

Do inverse NMO application — If checked, the inverse NMO correction will be applied, instead of the usual forward NMO.

Birefringence Analysis - 2C

Usage:

The splitting of shear waves into fast and slow components is called Birefringence. Analysis of the split shear waves allow the data recorded in the acquisition, or inline-crossline coordinate system to be rotated into the frame of reference of the principal axes of the azimuthally anisotropic medium. The rotated data correspond to the radial and transverse components of motion. The 2C Birefringence analysis rotates the receiver components through 180 degrees and a time shift of up to +/- 50% of the analysis window to maximize the radial component energy of an inline source or the transverse component energy of a crossline source. The analysis also provides an estimate of the azimuth of anisotropy.

Input Links:

- 1) Seismic data in common-receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.

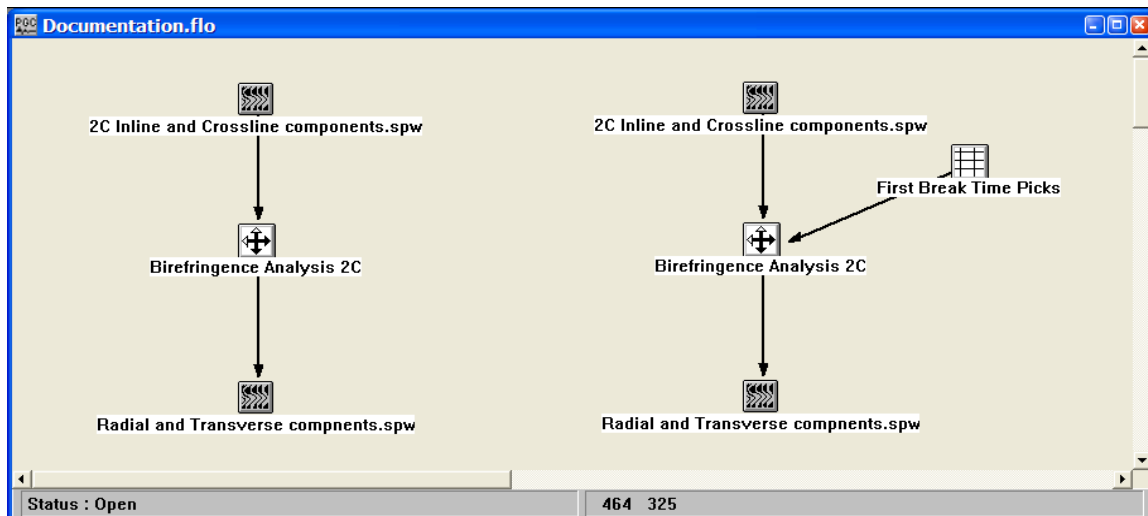
Output Links:

- 1) Seismic data rotated into principal axis of the azimuthally anisotropic medium in common receiver order with strike angle of the principal axis in User Def 1 trace header (mandatory).

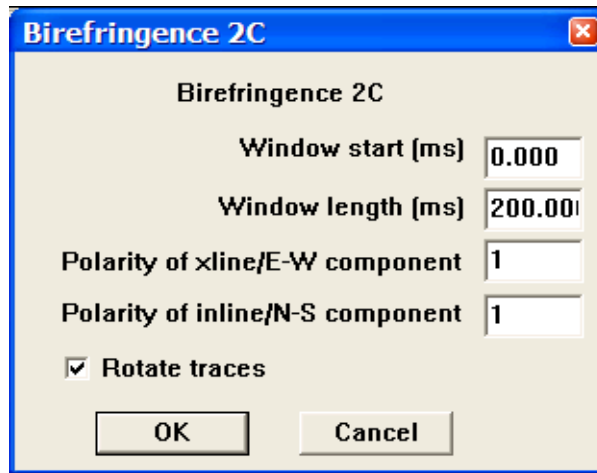
Reference:

Alford, R. M., 1986 Shear data in the presence of azimuthal anisotropy: Dilley, Texas: Presented at the 56th Annual SEG Meeting, Houston, Texas.

Example Flowchart:



Step Parameter Dialog:

The image shows a software dialog box titled "Birefringence 2C". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. At the top, the title "Birefringence 2C" is centered. Below it, there are four input fields: "Window start (ms)" with a value of "0.000", "Window length (ms)" with a value of "200.000", "Polarity of xline/E-W component" with a value of "1", and "Polarity of inline/N-S component" with a value of "1". Below these fields is a checkbox labeled "Rotate traces" which is checked. At the bottom, there are two buttons: "OK" and "Cancel".

Birefringence 2C

Window start (ms) 0.000

Window length (ms) 200.000

Polarity of xline/E-W component 1

Polarity of inline/N-S component 1

☒ Rotate traces

OK Cancel

Parameter Description:

Window start (ms) — If a First Break Time Pick file is not linked to the Birefringence step, this value will indicate the start time of the analysis. If a First Break Time Pick file is linked to the Birefringence step, this value will indicate the start time of the analysis with respect to the first break time.

Window length (ms) — Length of birefringence analysis following start time.

Polarity of xline/E-W component — Defines polarity of crossline component.

Polarity of inline/N-S component — Defines polarity of inline component.

Rotate trace – If checked, the optimum rotation angle determined by the Birefringence analysis is applied to the output data. Otherwise, only the analysis is performed.

Birefringence Analysis - 4C

Usage:

The splitting of shear waves into fast and slow components is called Birefringence. Analysis of the split shear waves allow the data recorded in the acquisition, or inline-crossline coordinate system to be rotated into the frame of reference of the principal axes of the azimuthally anisotropic medium. The rotated data correspond to the radial and transverse components of motion. . The 4C Birefringence analysis requires as input the inline and crossline receiver components recorded by horizontal inline and crossline sources, respectively. The analysis computes the optimum rotation angle and time delay that maximizes the radial component energy of an inline source or the transverse component energy of a crossline source. The analysis also provides an estimate of the azimuth of anisotropy.

Input Links:

- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.

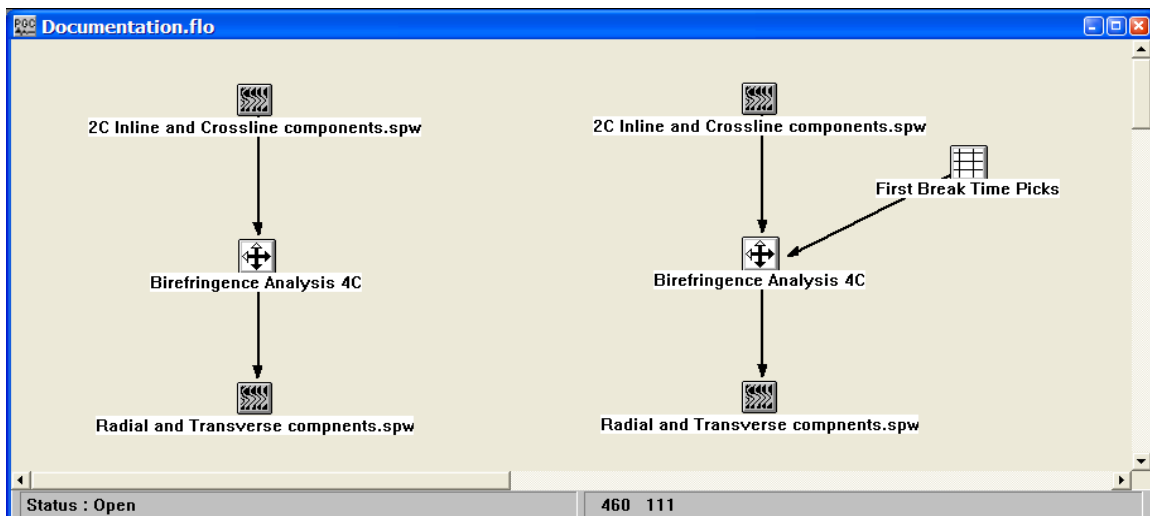
Output Links:

- 1) Seismic data rotated into principal axis of the azimuthally anisotropic medium in common receiver order with strike angle of the principal axis in User Def 1 trace header (mandatory).

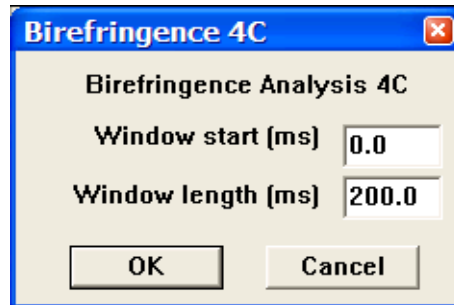
Reference:

Alford, R. M., 1986 Shear data in the presence of azimuthal anisotropy: Dilley, Texas: Presented at the 56th Annual SEG Meeting, Houston, Texas.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window start (ms) — If a First Break Time Pick file is not linked to the Birefringence step, this value will indicate the start time of the analysis. If a First Break Time Pick file is linked to the Birefringence step, this value will indicate the start time of the analysis with respect to the first break time.

Window length (ms) — Length of birefringence analysis following start time.

CCP Binning

Usage: The Common-Conversion Point (CCP) binning step assigns CCP numbers to mode-converted PS data as a function of the source-receiver offset and a constant or time-variable V_p/V_s ratio (gamma).

Input Links:

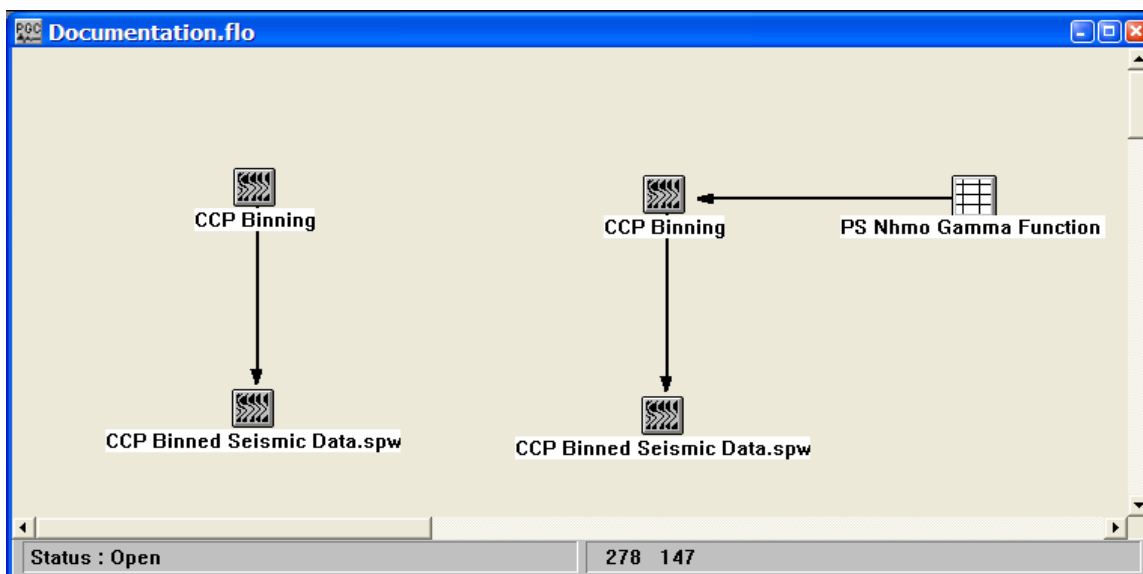
- 1) Converted wave data volume in any sort order (mandatory).
- 2) PS Nhmo gamma function card (optional).

Output Links:

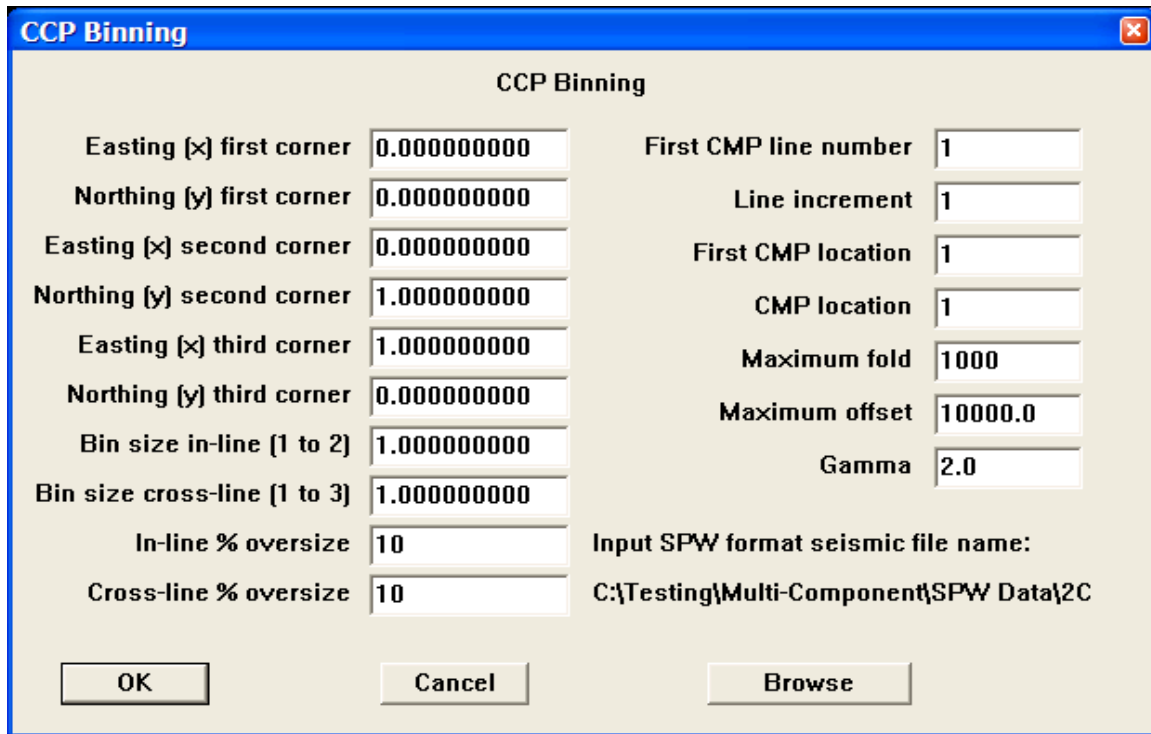
- 1) Converted wave data volume in any sort order (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "CCP Binning". It contains two columns of input fields. The left column includes: "Easting [x] first corner" (0.000000000), "Northing [y] first corner" (0.000000000), "Easting [x] second corner" (0.000000000), "Northing [y] second corner" (1.000000000), "Easting [x] third corner" (1.000000000), "Northing [y] third corner" (0.000000000), "Bin size in-line (1 to 2)" (1.000000000), "Bin size cross-line (1 to 3)" (1.000000000), "In-line % oversize" (10), and "Cross-line % oversize" (10). The right column includes: "First CMP line number" (1), "Line increment" (1), "First CMP location" (1), "CMP location" (1), "Maximum fold" (1000), "Maximum offset" (10000.0), "Gamma" (2.0), and a text field for "Input SPW format seismic file name:" containing "C:\Testing\Multi-Component\SPW Data\2C". At the bottom are three buttons: "OK", "Cancel", and "Browse".

CCP Binning	
Easting [x] first corner	0.000000000
Northing [y] first corner	0.000000000
Easting [x] second corner	0.000000000
Northing [y] second corner	1.000000000
Easting [x] third corner	1.000000000
Northing [y] third corner	0.000000000
Bin size in-line (1 to 2)	1.000000000
Bin size cross-line (1 to 3)	1.000000000
In-line % oversize	10
Cross-line % oversize	10
First CMP line number	1
Line increment	1
First CMP location	1
CMP location	1
Maximum fold	1000
Maximum offset	10000.0
Gamma	2.0
Input SPW format seismic file name: C:\Testing\Multi-Component\SPW Data\2C	

OK Cancel Browse

Parameter Description:

Easting (x) first corner — Enter the easting coordinate of the first corner of your survey.

Northing (y) first corner — Enter the northing coordinate of the first corner of your survey.

Easting (x) second corner — Enter the easting coordinate of the second corner of your survey.

Northing (y) second corner — Enter the northing coordinate of the second corner of your survey.

Easting (x) third corner — Enter the easting coordinate of the third corner of your survey.

Northing (y) third corner — Enter the northing coordinate of the third corner of your survey.

Bin size in-line (1 to 2) — Enter the size in distance units of the in-line side of each bin.

Bin size cross-line (1 to 3) — Enter the size in distance units of the cross-line side of each bin.

In-line % oversize — Enter the percent of the in-line bin dimension used to extend the bin in the in-line direction.

Cross-line % oversize — Enter the percent of the cross-line bin dimension used to extend the bin in the cross-line direction.

First CMP line number — Enter the first CMP line number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

Line increment — Enter the increment in line numbers between adjacent CMP lines.

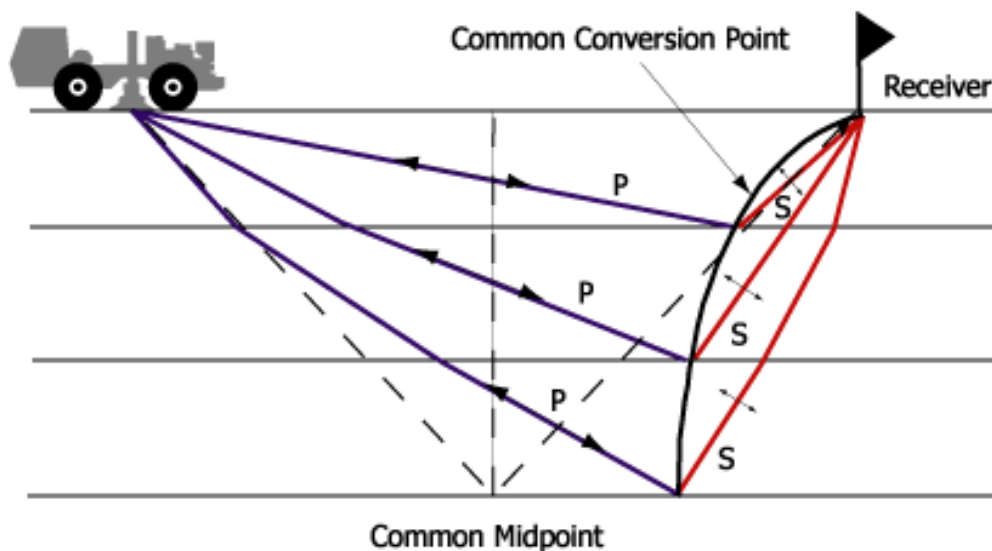
First CMP location number — Enter the first CMP location number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

CMP location increment — Enter the increment in locations between adjacent CMP locations.

Maximum Fold — Enter the maximum allowable fold attainable after flex binning.

Maximum Offset — Enter the maximum allowable source-receiver offset among traces in neighboring bins used to increase fold.

Gamma — Enter the assumed V_p/V_s ratio (gamma) used to determine the offset to the P-to-S conversion point. If a PS Nthmo gamma function card file is not linked to the CCP Binning step, this is the constant gamma value used to determine the offset to the P-to-S conversion points.



The above figure illustrates the difference between the location of the common-conversion point and the common midpoint.

CCP Fold - Geometry

Usage:

The CCP Fold – Geometry step extracts common asymptotic conversion point fold from the source, receiver, and cross-reference SPS card data files.

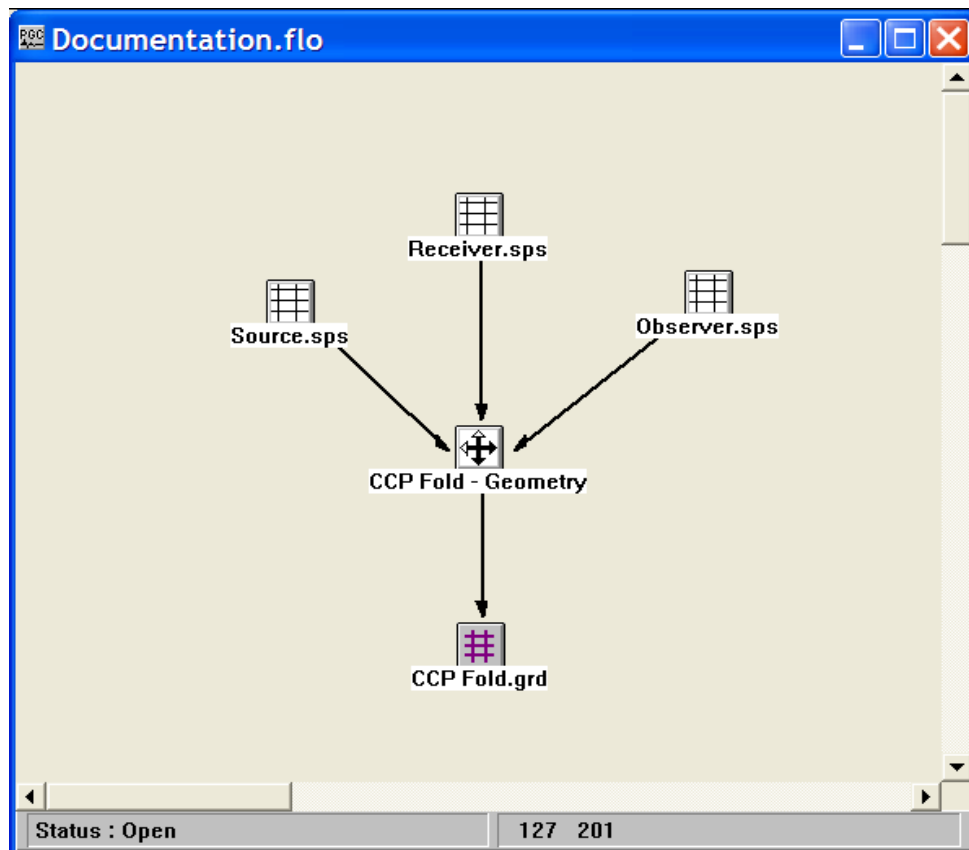
Input Links:

- 4) Observers Notes – SPS Format cards (mandatory).
- 5) Receiver Locations – SPS Format cards (mandatory).
- 6) Source Locations – SPS Format cards (mandatory).

Output Links:

- 1) CCP Fold Image file (mandatory).

Example Flowchart:



Step Parameter Dialog:

CCP Fold - Geometry			
Easting [x] first corner	0.000000000	First CCP line number	1
Northing [y] first corner	0.000000000	Line increment	1
Easting [x] second corner	0.000000000	First CCP location number	1
Northing [y] second corner	1.000000000	CCP location increment	1
Easting [x] third corner	1.000000000	Gamma	2.00
Northing [y] third corner	0.000000000		
Bin size in-line (1 to 2)	1.000000000		
Bin size cross-line (1 to 3)	1.000000000		

OK Cancel

Parameter Description:

Easting (x) first corner — Enter the easting coordinate of the first corner of your survey.

Northing (y) first corner — Enter the northing coordinate of the first corner of your survey.

Easting (x) second corner — Enter the easting coordinate of the second corner of your survey.

Northing (y) second corner — Enter the northing coordinate of the second corner of your survey.

Easting (x) third corner — Enter the easting coordinate of the third corner of your survey.

Northing (y) third corner — Enter the northing coordinate of the third corner of your survey.

Bin size in-line (1 to 2) — Enter the size in distance units of the in-line side of each bin.

Bin size cross-line (1 to 3) — Enter the size in distance units of the cross-line side of each bin.

First CMP line number — Enter the first CMP line number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

Line increment — Enter the increment in line numbers between adjacent CMP lines.

First CMP location number — Enter the first CMP location number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

CMP location increment — Enter the increment in locations between adjacent CMP locations.

Gamma — Enter the constant gamma used to compute the asymptotic source-receiver conversion point.

Constant Gamma Stacks

Usage:

The Constant Gamma Stack step generates a file of constant gamma stack traces, where gamma is defined as the V_p/V_s ratio. A P-wave stacking velocity field must be supplied, and you choose the number of gammas with which to stack your data, the first gamma to apply, and the last gamma to apply. You have the option to apply a stretch mute, if you so desire. With the series of constant gamma stack traces, you page through these stacked panels in SeisViewer and interactively pick gamma functions that result in the most coherent stacked sections.

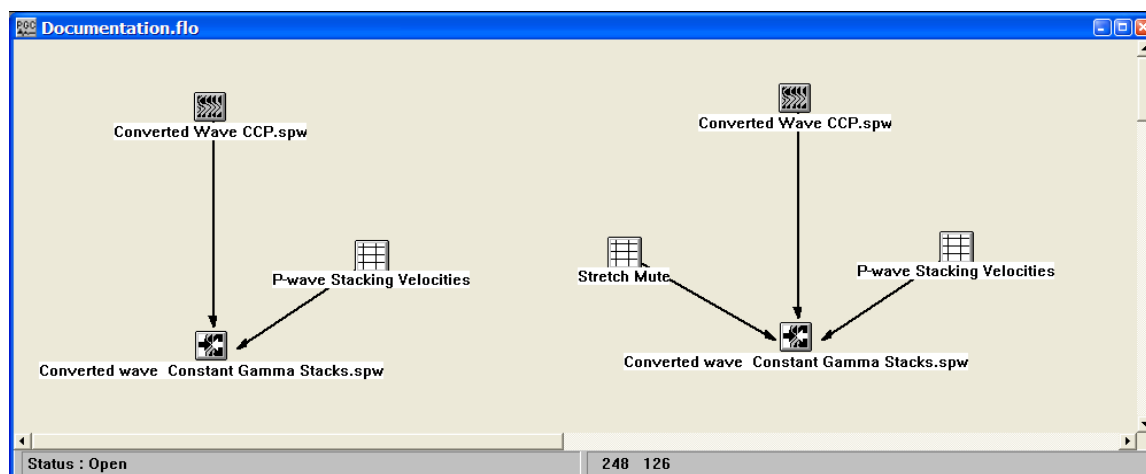
Input Links:

- 1) Seismic data pre-stack, in CMP sort order (mandatory).
- 2) Velocity card data file containing p-wave stacking velocity functions (mandatory).

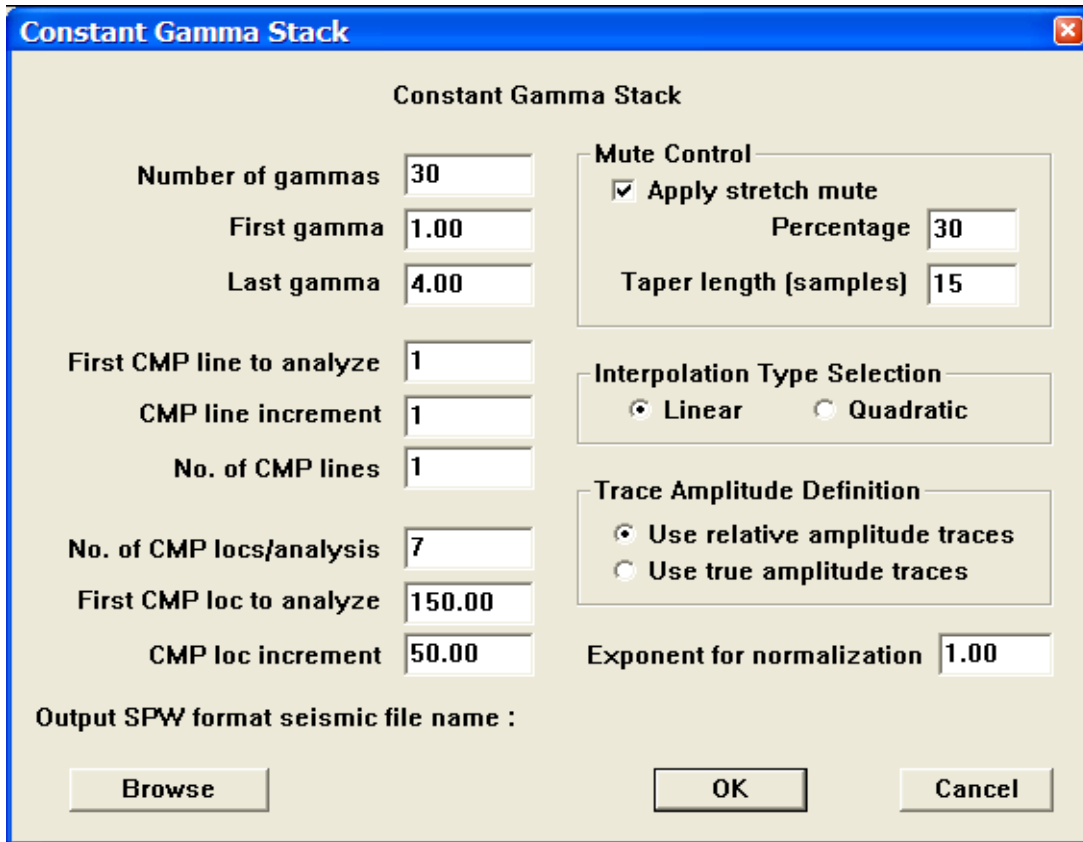
Output Links:

None - This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Constant Gamma Stack". It contains several input fields and control groups. On the left, there are fields for "Number of gammas" (30), "First gamma" (1.00), "Last gamma" (4.00), "First CMP line to analyze" (1), "CMP line increment" (1), "No. of CMP lines" (1), "No. of CMP locs/analysis" (7), "First CMP loc to analyze" (150.00), and "CMP loc increment" (50.00). On the right, there is a "Mute Control" group with a checked "Apply stretch mute" checkbox, a "Percentage" field (30), and a "Taper length [samples]" field (15). Below that is an "Interpolation Type Selection" group with radio buttons for "Linear" (selected) and "Quadratic". Further down is a "Trace Amplitude Definition" group with radio buttons for "Use relative amplitude traces" (selected) and "Use true amplitude traces". At the bottom right is an "Exponent for normalization" field (1.00). At the bottom left, there is a label "Output SPW format seismic file name :" followed by a "Browse" button. At the bottom center are "OK" and "Cancel" buttons.

Constant Gamma Stack	
Number of gammas	30
First gamma	1.00
Last gamma	4.00
First CMP line to analyze	1
CMP line increment	1
No. of CMP lines	1
No. of CMP locs/analysis	7
First CMP loc to analyze	150.00
CMP loc increment	50.00
Output SPW format seismic file name :	
Browse	
OK	Cancel

Parameter Description:

Number of gammas — Enter the number of gammas to use in the analysis. A stacked section is calculated for each gamma linearly interpolated between the starting and ending input gamma. The gamma increment will be:

$$G_{inc} = (\text{last gamma} - \text{first gamma}) / (\text{Number of gammas} - 1).$$

First gamma — Enter the starting gamma for the analysis. This gamma will be used for non-hyperbolic NMO on the first output stack. {>0.0}

Last gamma — Enter the ending gamma for the analysis. This gamma will be used for non-hyperbolic NMO on the last output stack. {>0.0}

First CMP line to analyze — Enter the first CMP line number to analyze.

CMP line increment — Enter the CMP line increment between lines to analyze.

No. of CMP lines — Enter the number of CMP lines to analyze.

No. of CMP locs/analysis — Enter the number of CMP locations in each analysis panel. At each CMP location a range of constant velocity stacks will be generated from the first velocity to the last velocity in increments of V_{inc}

First CMP loc to analyze — Enter the first CMP location to analyze.

CMP loc increment — Enter the CMP location increment between groups of CMP locations to analyze.

Mute Control

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction. If not check, the stretch mute must be supplied by an Early Mute card linked to the Constant Gamma Stack step.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace Amplitude Definition — Select the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Browse — Select an existing SPW format seismic file or enter the name of a new SPW format seismic file to use for output from the process.

Convert PS Time Picks

Usage: The Convert PS Time Picks step maps P-wave event times to PS-wave event times using a user supplied gamma (V_p/V_s) function. Alternatively, the step can map PS-wave event times to P-wave event times.

Input Links:

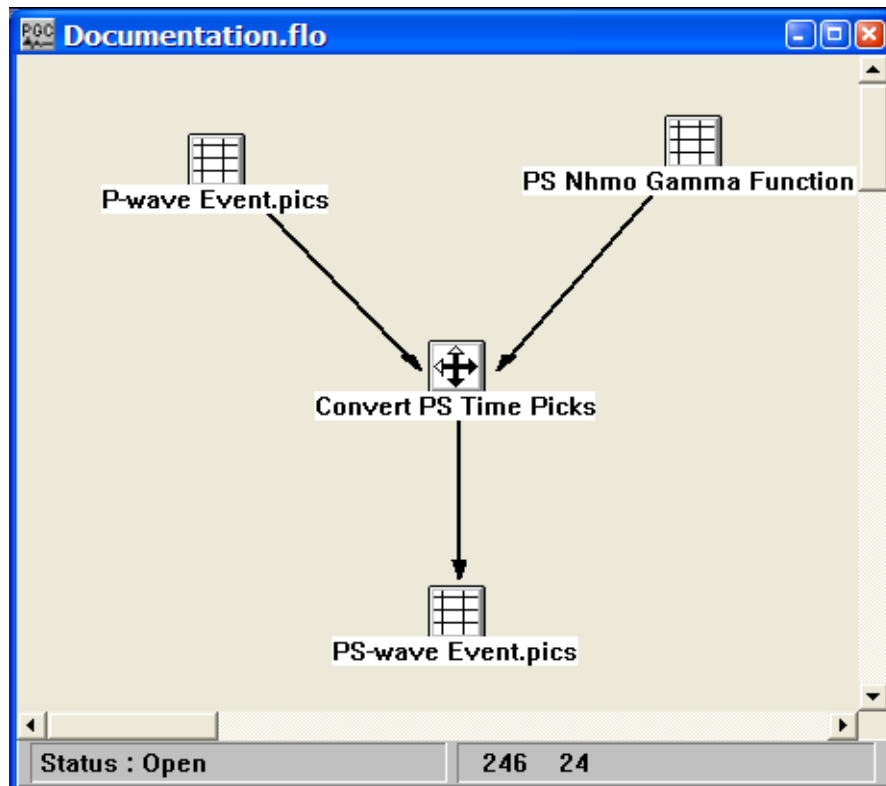
- 1) Horizon Picks file containing either P-wave event times or PS-wave event times (mandatory).
- 2) PS Nhmo Gamma Function card (mandatory).

Output Links:

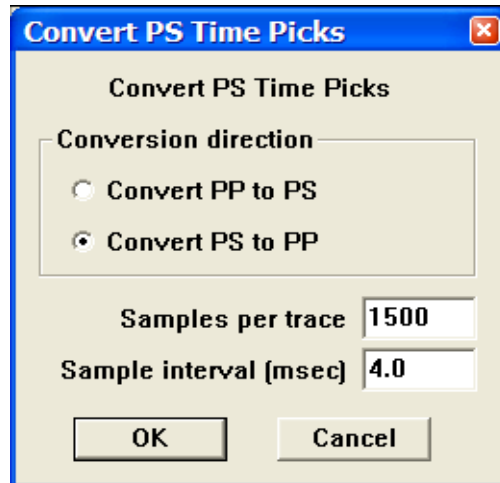
- 1) Horizon Picks file containing PS-wave event times or P-wave event times (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Conversion direction — Select the type of time pick conversion. If the input times were picked on P-wave data, select Convert PP to PS. If the input times were picked on PS-wave data, select Convert PS to PP.

Convert PP to PS — Maps P-wave event times to PS-wave event times.

Convert PS to PP — Maps PS-wave event times to P-wave event times.

Samples per trace — Enter the number of samples per trace in the seismic data from which the event times were picked.

Sample interval (ms) — Enter the sample interval of the seismic data from which the event times were picked.

Dual Summation

Usage: The Dual Summation step scales the pressure sensor data (hydrophone) to the same range as the co-located vertical-component geophone data. After scaling, the two recordings are summed so that the spectral notch resulting from the receiver water-surface ghost will be eliminated. If the input data are 4C, the Dual Summation step will output enhanced 3C data. If the input data are 2C, the Dual Summation step will output enhanced single-component data

Input Links:

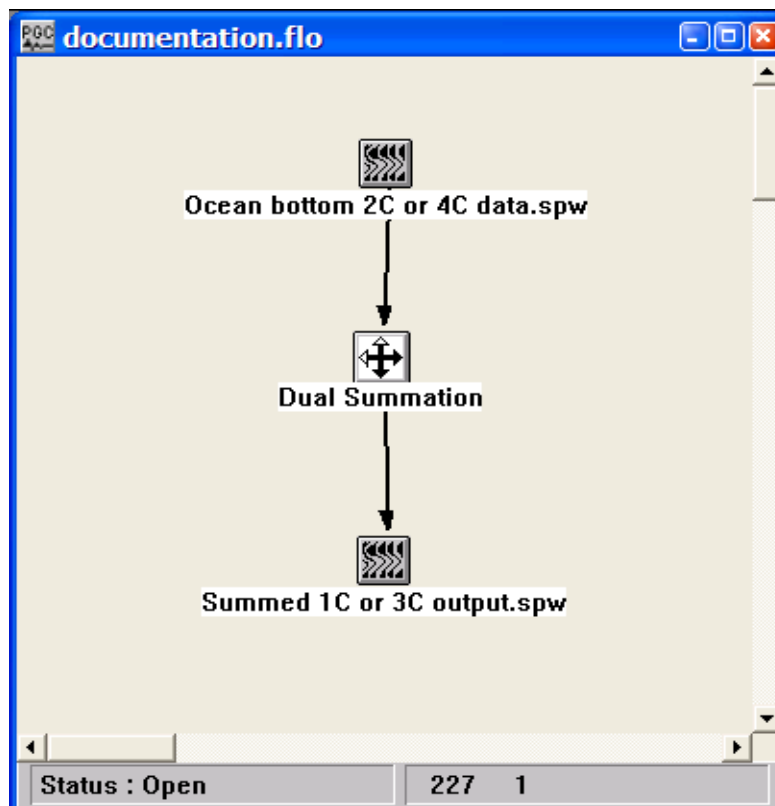
- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with the source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.

Output Links:

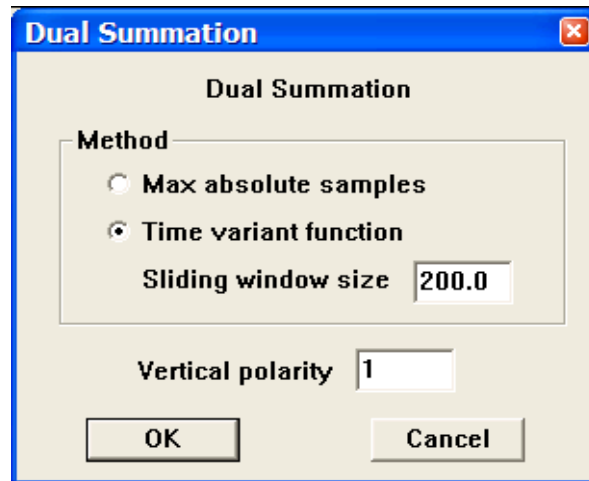
- 1) 1C or 3C seismic data in common-receiver gather sort order (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Method — Select the analysis method to determine the dual sensor summation factors.

Max absolute samples — If selected, the geophone scale factor will be equal to the ratio of the maximum absolute value of the geophone trace to the maximum absolute value of the hydrophone trace.

Time variant function — If selected, the geophone scale factor will be a time variant function controlled by a sliding window.

Sliding window size – size of the window, in ms, over which the dual sensor summation factors are calculated.

Vertical polarity - Defines polarity of the vertical component.

Horizontal Rotation

Usage:

The Horizontal Rotation step rotates the two horizontal components of a multi-component data volume through rotation angles determined by the (1) source-receiver azimuth, (2) the azimuth of the inline component, and (3) the azimuth of the crossline component. The step outputs a single data file consists of rotated radial (Receiver Component = 17) and transverse (Receiver Component = 16) component traces.

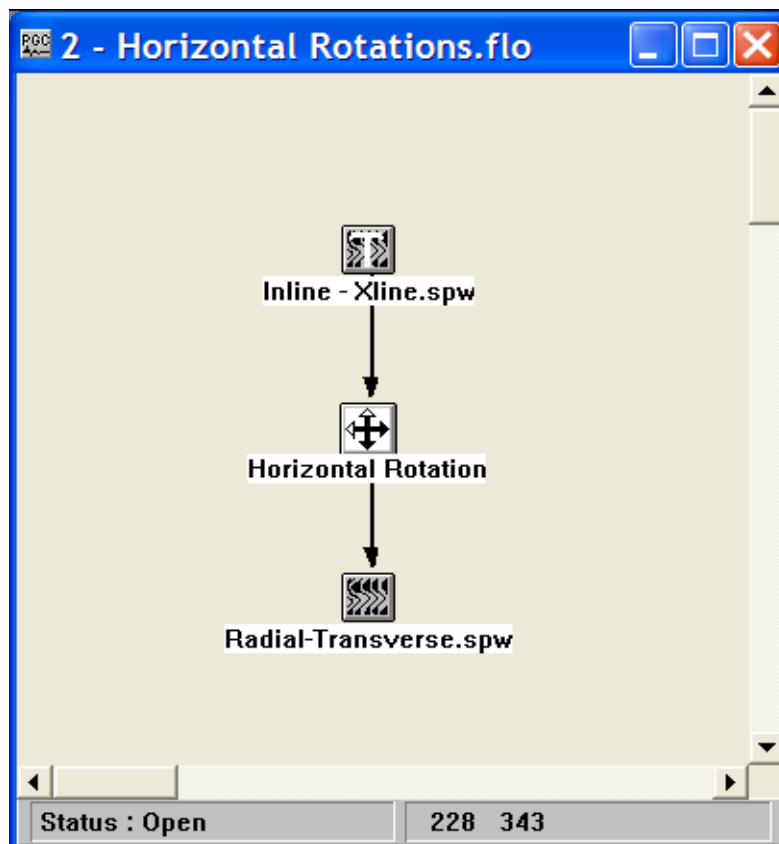
Input Links:

- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.

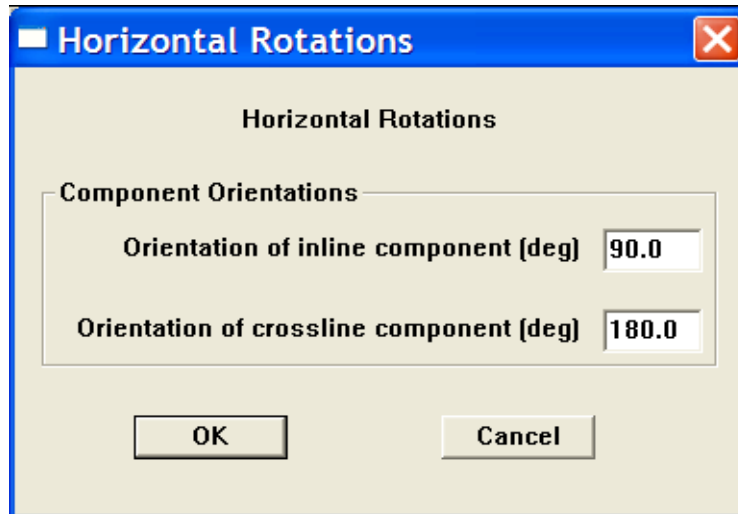
Output Links:

- 1) Seismic data in common receiver order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Horizontal Rotations". It has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. Inside, there is a section titled "Component Orientations" which contains two text input fields. The first field is labeled "Orientation of inline component (deg)" and contains the value "90.0". The second field is labeled "Orientation of crossline component (deg)" and contains the value "180.0". At the bottom of the dialog, there are two buttons: "OK" and "Cancel".

Horizontal Rotations	
Horizontal Rotations	
Component Orientations	
Orientation of inline component (deg)	90.0
Orientation of crossline component (deg)	180.0
OK	Cancel

Parameter Description:

Orientation of inline component – Enter the azimuth of the field orientation of the inline component receiver.

Orientation of crossline component – Enter the azimuth of the field orientation of the crossline component receiver.

Select Component

Usage:

The Select Component step is used to extract source and receiver components from multi-component seismic data based on the trace header types described at the beginning of the Multi-Component section.

Input Links:

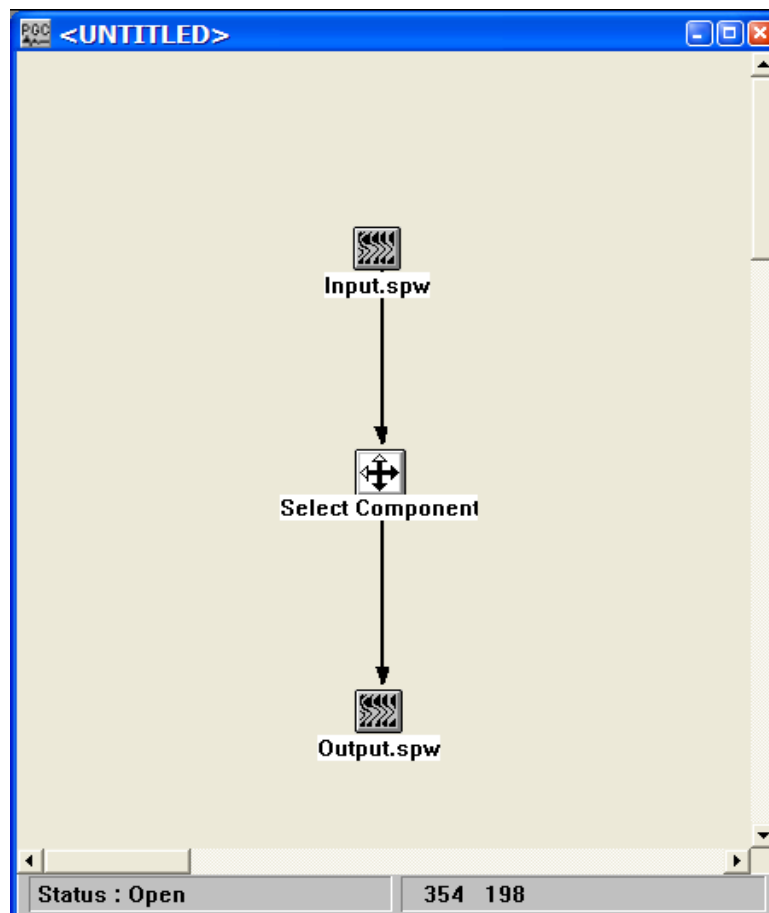
- 3) Multi-component seismic data (mandatory). The trace header must be updated with the source- and receiver-component types.

Output Links:

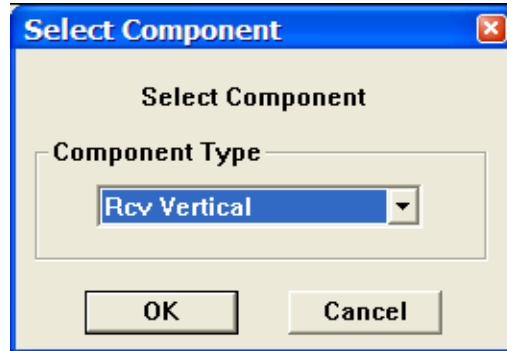
- 1) Seismic data containing selected source or receiver component (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Component Type – Use the drop down menu to select a source or receiver component.
Available components include:

- Receiver Pressure
- Receiver Vertical
- Receiver Inline
- Receiver Crossline
- Receiver Rotated Vertical
- Receiver Rotated Transverse
- Receiver Rotated Radial

- Source Vertical
- Source Inline
- Source Crossline
- Source Rotated Vertical
- Source Rotated Transverse
- Source Rotated Radial
- Source Summed Vertical

Three Component Rotations

Usage:

The Three Component Rotation step performs Euler rotations of three component data. Each rotation requires the specification of a rotation axis and a rotation angle. The rotation angles can be read from any of the trace header fields, or specified as a constant by the user.

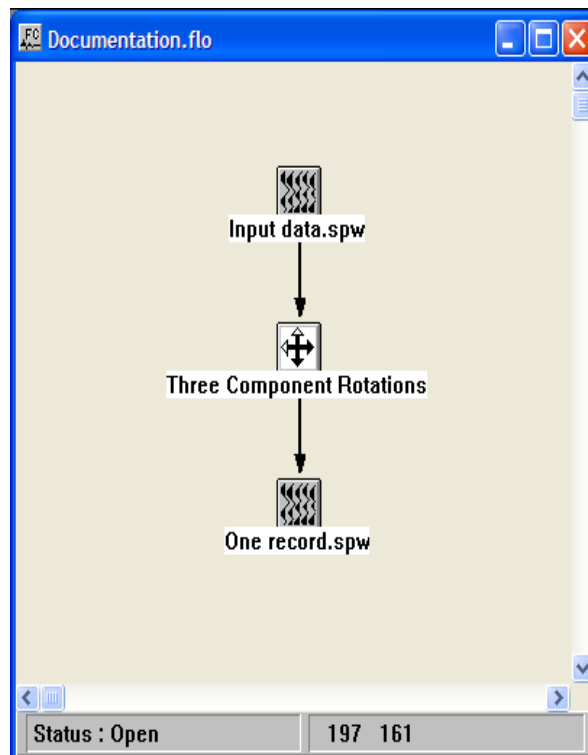
Input Links:

- 1) Seismic data sorted into three-component clusters (mandatory).

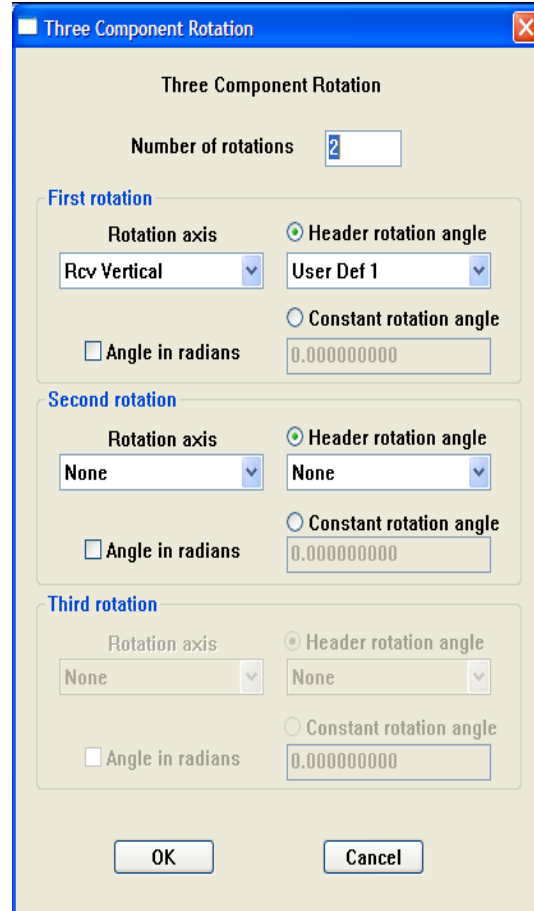
Output Links:

- 1) Rotated seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Three Component Rotation". It contains a "Number of rotations" field set to 2. Below this are three sections for "First rotation", "Second rotation", and "Third rotation". Each section has a "Rotation axis" dropdown, a "Header rotation angle" radio button (selected), a "Constant rotation angle" radio button, an "Angle in radians" checkbox, and a text entry field for the rotation angle. The "First rotation" section has "Rcv Vertical" for the axis and "User Def 1" for the header angle. The "Second" and "Third" rotation sections have "None" for the axis and "None" for the header angle. All "Constant rotation angle" and "Angle in radians" fields are set to 0.00000000. "OK" and "Cancel" buttons are at the bottom.

Parameter Description:

Number of rotations — Indicate the number of rotations to be performed.

First rotation (Number of rotations ≥ 1)

Rotation axis – Select the component axis about which to perform this rotation.

Header rotation angle – If the Header rotation angle radio button is selected, then the rotation angle will be read from the trace header field selected in the adjacent drop down menu.

Constant rotation angle – If the Constant rotation angle radio button is selected, then the rotation angle will be read from the user supplied value in the adjacent text entry box.

Angle in radians – If checked, the rotation angle will be read in units of radians.

Otherwise, the rotation angle will be read in units of degrees.

Second rotation (Number of rotations ≥ 2)

Rotation axis – Select the component axis about which to perform this rotation.

Header rotation angle – If the Header rotation angle radio button is selected, then the rotation angle will be read from the trace header field selected in the adjacent drop down menu.

Constant rotation angle – If the Constant rotation angle radio button is selected, then the rotation angle will be read from the user supplied value in the adjacent text entry box.

Angle in radians – If checked, the rotation angle will be read in units of radians. Otherwise, the rotation angle will be read in units of degrees

Third rotation (Number of rotations = 3)

Rotation axis – Select the component axis about which to perform this rotation.

Header rotation angle – If the Header rotation angle radio button is selected, then the rotation angle will be read from the trace header field selected in the adjacent drop down menu.

Constant rotation angle – If the Constant rotation angle radio button is selected, then the rotation angle will be read from the user supplied value in the adjacent text entry box.

Angle in radians – If checked, the rotation angle will be read in units of radians. Otherwise, the rotation angle will be read in units of degrees

Two Component Horizontal Rotation

Usage:

The Two Component Horizontal Rotation step computes the rotation required to transform the horizontal components of a multi-component data volume recorded in the acquisition, or inline-crossline coordinate system into the vertical-radial-transverse frame of reference defined by the source-receiver azimuth. These rotations are then applied by the Apply Horizontal Rotation step. The rotation angles can be determined from (1) a covariance analysis of a user-defined portion of the seismic record, (2) a constant, user-specified angle, or (3) by scanning for the rotation angle that maximizes energy among the horizontal components. The analysis start time may be referenced to the first break wavelet using pick times stored in an Early Mute card file.

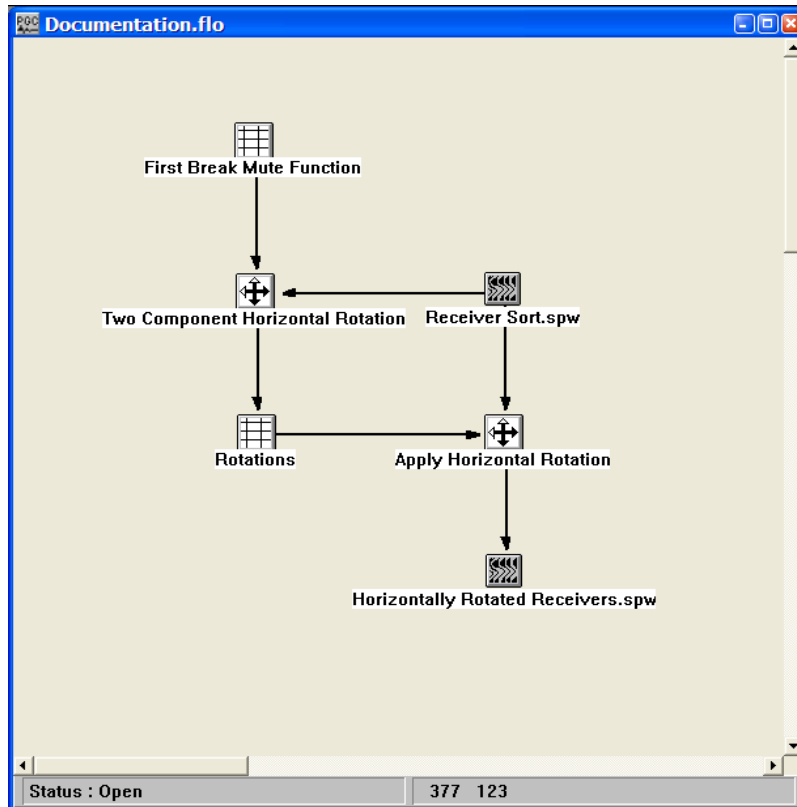
Input Links:

- 4) Seismic data in common receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.
- 5) Early Mute file containing time picks prior to the first breaks (optional).

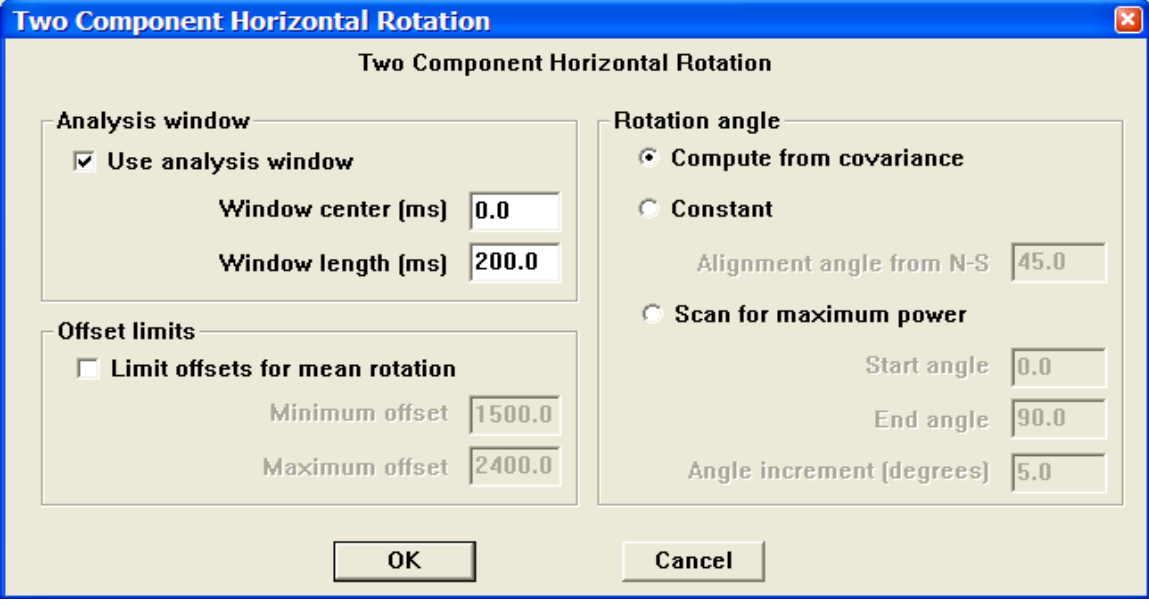
Output Links:

- 2) Rotations Card data file containing a list of the rotation estimates for each source-receiver pair (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Two Component Horizontal Rotation". It contains three main sections: "Analysis window", "Offset limits", and "Rotation angle".

- Analysis window:** Includes a checked checkbox "Use analysis window". Below it are two input fields: "Window center (ms)" with a value of 0.0, and "Window length (ms)" with a value of 200.0.
- Offset limits:** Includes an unchecked checkbox "Limit offsets for mean rotation". Below it are two input fields: "Minimum offset" with a value of 1500.0, and "Maximum offset" with a value of 2400.0.
- Rotation angle:** Includes three radio button options: "Compute from covariance" (selected), "Constant", and "Scan for maximum power".
 - Under "Constant", there is an input field "Alignment angle from N-S" with a value of 45.0.
 - Under "Scan for maximum power", there are two input fields: "Start angle" with a value of 0.0, and "End angle" with a value of 90.0.
 - Below these is an input field "Angle increment (degrees)" with a value of 5.0.

At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Analysis window

Use analysis window — If checked, the rotation analysis will be based on the specified window of data. If a First Break Pick Time card is linked to the Two-Component Horizontal Rotation step, then the analysis will be based on a window centered about the first break pick time.

Window center (ms) – The center of the rotation analysis window. If the analysis window is referenced to a first-break pick file, a time of 0 ms corresponds to the first-break pick time.

Window length (ms) – The length of the analysis window. The analysis window will extend from $(\text{window_center} - \text{window_length}/2)$ to $(\text{window_center} + \text{window_length}/2)$. If a First Break Pick Time card is linked to the step, these values will be with respect to the first break time.

Offset limits

Limit offsets for mean rotation – If checked, the rotation angle used to rotate receiver will be the mean value for that receiver determined from the analysis of all data within a specified offset range. Source-receiver azimuth for each of the traces used in the analysis is taken into account.

Minimum offset – The minimum absolute offset used to determine the rotation angle.

Maximum offset – The maximum absolute offset used to determine the rotation angle.

Rotation angle

Compute from covariance — If checked, a covariance analysis will be performed to determine the principal axes defined by the horizontal components. The azimuth of the principal axis will be output to the rotation card file.

Constant — If checked, the constant, user-specified rotation angle will be applied.

Scan for maximum power — If checked, the two horizontal components will be rotated through the user-specified range of angles. The angle that results in maximum power will be output to the Rotation card file.

Alignment angle from N-S – If the Compute rotation angle option is not checked (and the optimum rotation angle is not determined through analysis), allows rotation from a preferred azimuth.

Polarity

Polarity of xline/E-W component – Defines polarity of crossline component. Valid values are +/- 1.

Polarity of inline/N-S component – Defines polarity of inline component. Valid values are +/- 1.

Wavefield Separation

Usage:

The Wavefield Separation step is designed to extract the compressional and shear wavefield from three-component or full-vector recordings based on the polarization attributes of the P- and S- wavefield. The polarization attributes of a three-component recording are extracted through covariance analysis of a window of the recording.

Input Links:

- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with the source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.
- 2) Early Mute card file (mandatory).

Output Links:

- 1) Seismic data file containing the P-wave or the S-wave three-component wavefield (mandatory).

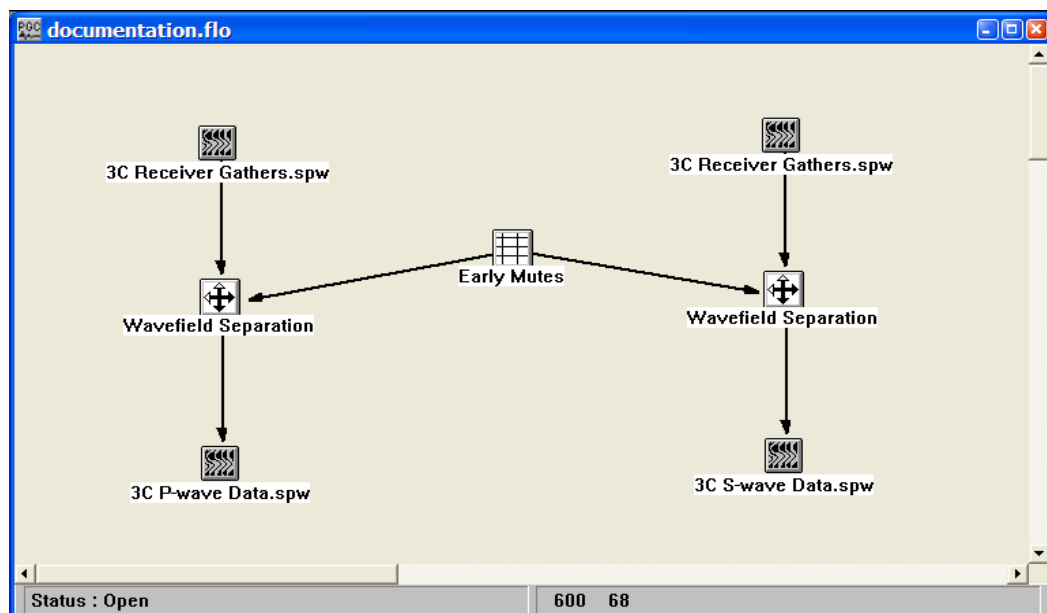
Reference:

Flinn, E. A., 1965, Signal analysis using rectilinearity and direction of particle motion: IEEE Proc., **12**, 1874-1876.

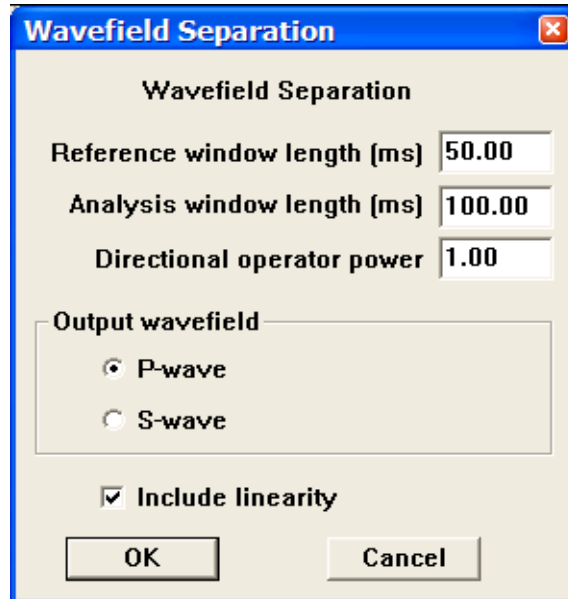
Jurkevics, A., 1988, Polarization analysis of three-component array data: Bull. Seis. Am., **78**, 1725-1743.

Jackson, G. M., Mason, I. M., and Greenhalgh, S. A., 1991, Principal component transforms of triaxial recording by singular value decomposition: Geophysics, **56**, 528-533.

Example Flowchart:



Step Parameter Dialog:

The image shows a software dialog box titled "Wavefield Separation". It has a blue title bar with a close button (X) in the top right corner. The dialog contains several input fields and a checkbox. The first three are labeled "Reference window length (ms)", "Analysis window length (ms)", and "Directional operator power", each followed by a text box containing the values "50.00", "100.00", and "1.00" respectively. Below these is a section titled "Output wavefield" which contains two radio buttons: "P-wave" (which is selected) and "S-wave". At the bottom of the dialog is a checked checkbox labeled "Include linearity". At the very bottom are two buttons: "OK" and "Cancel".

Wavefield Separation

Reference window length (ms) 50.00

Analysis window length (ms) 100.00

Directional operator power 1.00

Output wavefield

☒ P-wave

☐ S-wave

☒ Include linearity

OK Cancel

Parameter Description:

Reference window length (ms) – Length of reference time window.

Analysis window length (ms) – Length of the covariance analysis window.

Directional operator power – Weighting coefficients are raised to the directional operator power.

Output Wavefield – Select whether the P-wave or the S-wave wavefield will be output.

P-wave – Outputs the P-wave wavefield.

S-wave – Outputs the S-wave wavefield.

Include linearity – If checked, the linearity attribute is used to weight the input wavefield to generate the output wavefield.

Mutes

This section documents the processing steps available in the Mutes category.

The types of mutes currently available are:



Apply Early Mute

Usage:

The Apply Early Mute step allows you to apply mute definitions in the Early Mute card to your data. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper. You may also specify the length of the mute taper. Early mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.

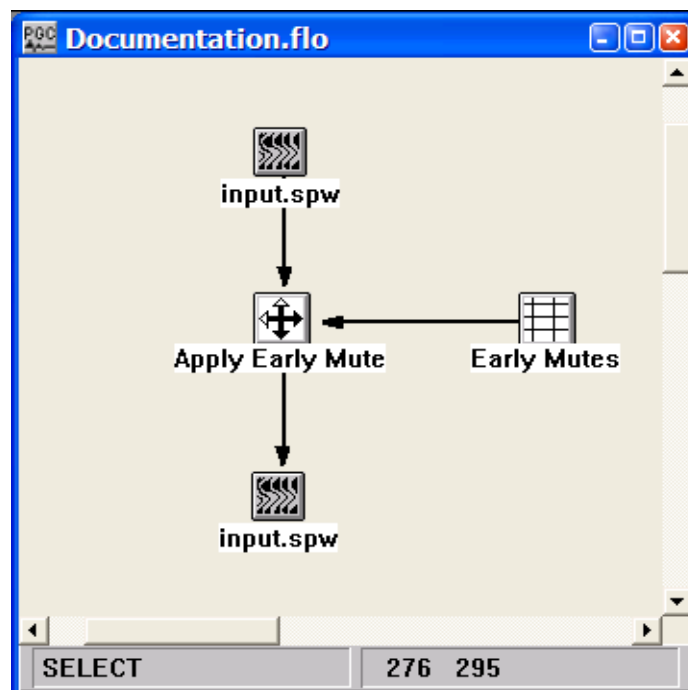
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Early Mutes cards (mandatory).

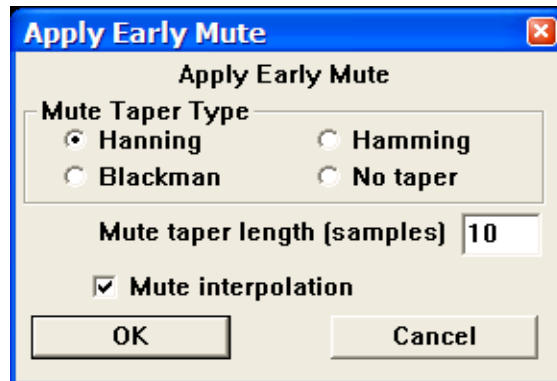
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Mute Taper Type — Select the type of taper to use when applying the mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos(2 * \pi * n / N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos(2 * \pi * n / N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos(2 * \pi * n / N) + 0.08 * \cos(4 * \pi * n / N)$.

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Mute Interpolation — If checked, the early mutes will be interpolated between the control points where picks were made.

Apply Surgical Mute

Usage:

The Apply Surgical Mute step allows you to apply a set of picked mute cards to your data. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper. You may also specify the length of the mute taper. Surgical mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.

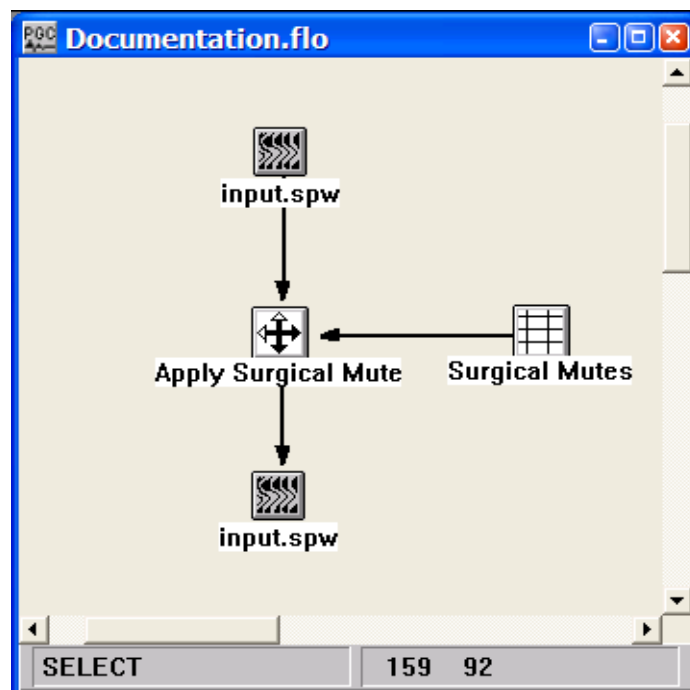
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Surgical Mutes cards (mandatory).

Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Mute Tape Type — Select the type of taper to use when applying the mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos(2 * \pi * n / N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos(2 * \pi * n / N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos(2 * \pi * n / N) + 0.08 * \cos(4 * \pi * n / N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Mute Interpolation — If checked, the surgical mutes will be interpolated between picked control points.

Apply Tail Mute

Usage:

The Apply Tail Mute step allows you to apply a set of picked mute cards to your data. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper. You may also specify the length of the mute taper. Tail mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.

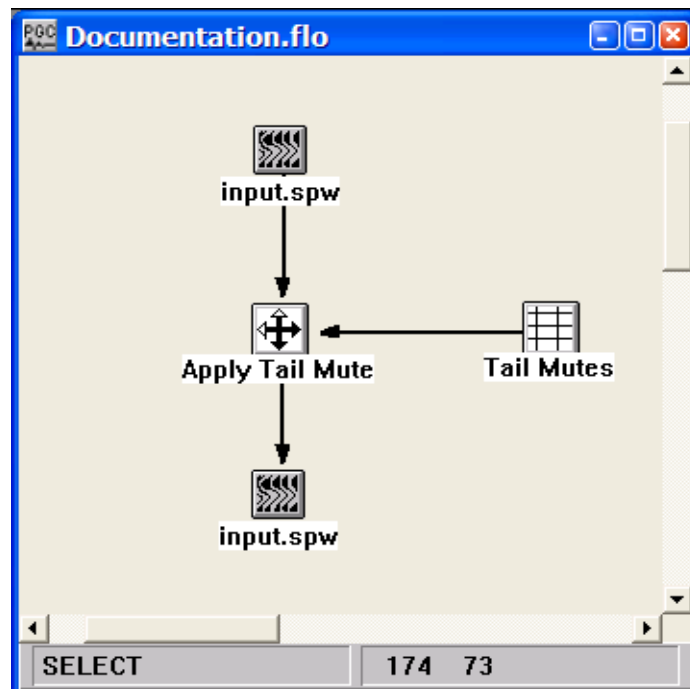
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 1) Tail Mutes cards (mandatory).

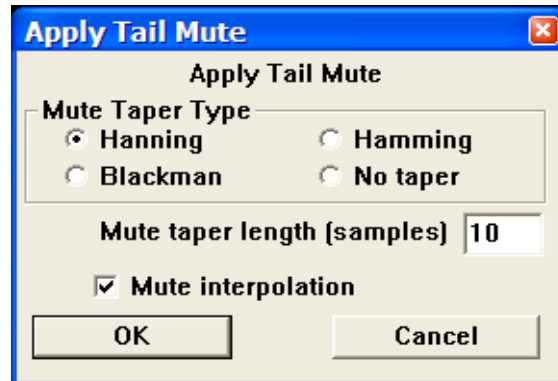
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Mute Tape Type — Select the type of taper to use when applying the mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos(2\pi n/N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos(2\pi n/N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos(2\pi n/N) + 0.08 * \cos(4\pi n/N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

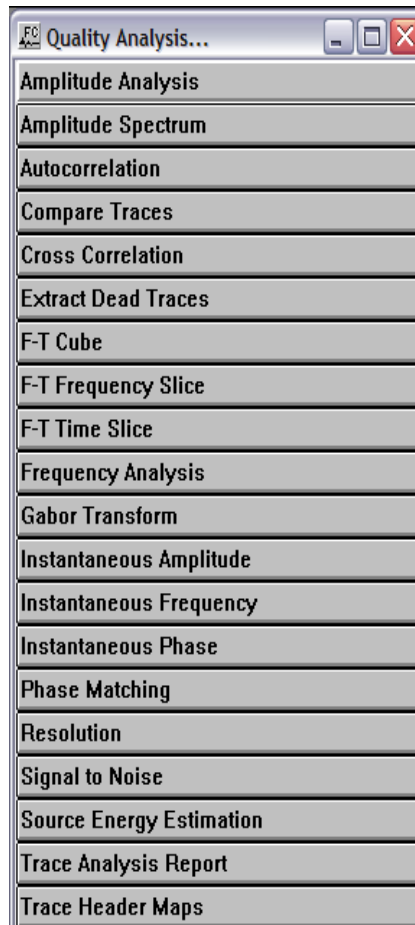
Mute taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Mute Interpolation — If checked, the tail mutes will be interpolated between picked control points.

Quality Analysis

This section documents the processing steps available in the Quality Analysis category.

The types of quality analysis currently available are:



Amplitude Analysis

Usage:

The Amplitude Analysis step performs single- or multi-channel analysis of sample amplitudes and updates a user specified trace header with the results of the analysis. Attribute types include RMS value, Average Magnitude, Maximum Magnitude, Maximum Amplitude, Median Value, and Energy.

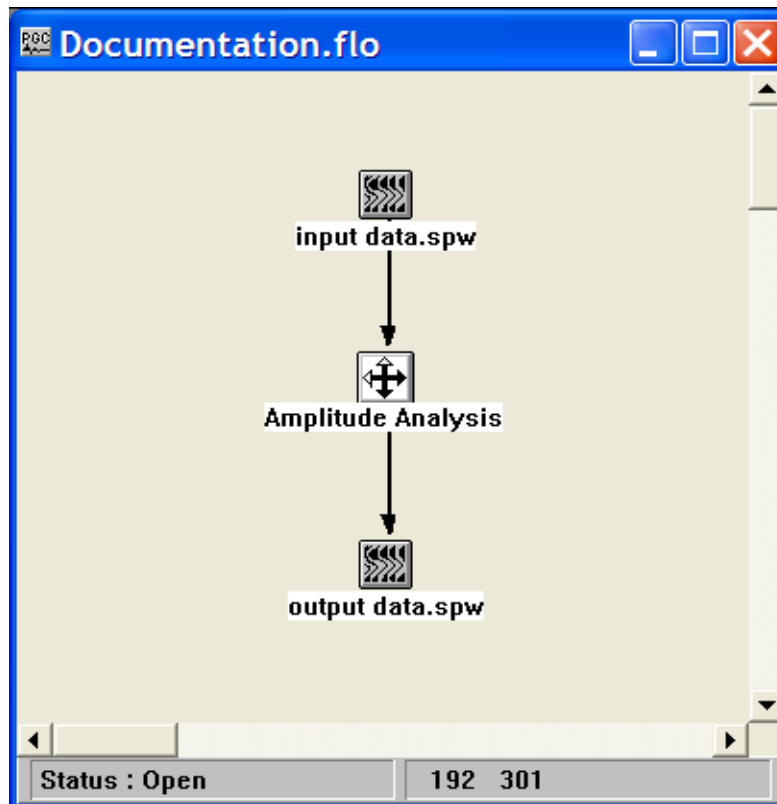
Input Links:

1) Seismic data in any order (mandatory).

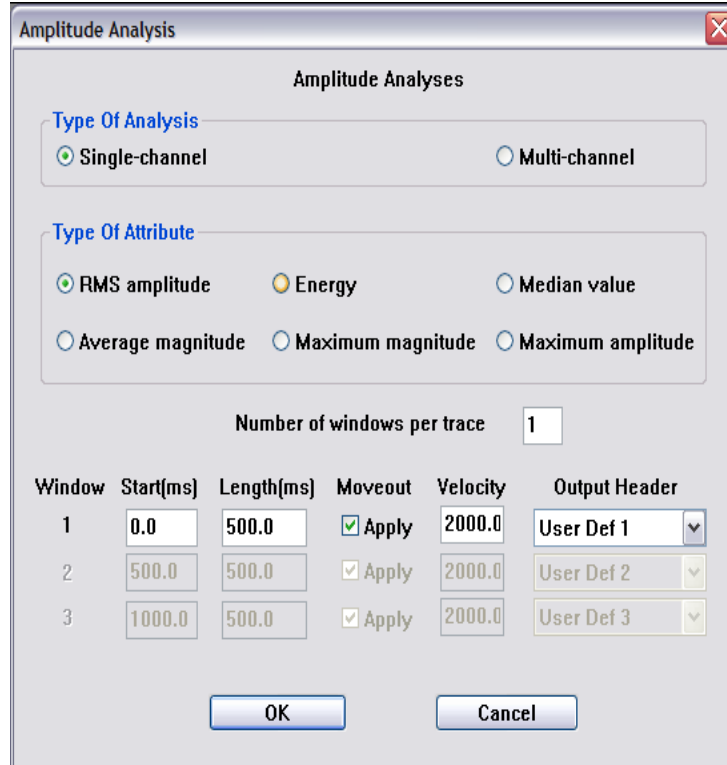
Output Links:

1) Seismic data amplitude spectrum attribute traces (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Amplitude Analysis" and contains the following sections:

- Amplitude Analyses**
 - Type Of Analysis:** Radio buttons for "Single-channel" (selected) and "Multi-channel".
 - Type Of Attribute:** Radio buttons for "RMS amplitude" (selected), "Energy", "Median value", "Average magnitude", "Maximum magnitude", and "Maximum amplitude".
- Number of windows per trace:** A text box containing the value "1".
- Table:** A table with 6 columns: Window, Start(ms), Length(ms), Moveout, Velocity, and Output Header. It contains 3 rows of data.
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Window	Start(ms)	Length(ms)	Moveout	Velocity	Output Header
1	0.0	500.0	<input checked="" type="checkbox"/> Apply	2000.0	User Def 1
2	500.0	500.0	<input checked="" type="checkbox"/> Apply	2000.0	User Def 2
3	1000.0	500.0	<input checked="" type="checkbox"/> Apply	2000.0	User Def 3

Parameter Description:

Type of Analysis — Specify whether the amplitude analysis will be single-channel or multi-channel. Single-channel attributes are calculated per trace. Multi-channel attributes are calculated from the ensemble of traces in an input gather.

Type of Attribute — Specify the type of amplitude attribute.

RMS – Calculate the root-mean-squared value in the analysis window.

Average magnitude – Calculate the average of the absolute values in the analysis window.

Maximum magnitude – Determine the maximum of the absolute values in the analysis window.

Energy – Calculate the sum of the squares of sample values in the analysis window.

Maximum amplitude – Determine the maximum value in the analysis window.

Median value – Determine the median value in the analysis window.

Number of windows per trace — Specify the number of analysis windows per trace for a single-channel analysis, or the number of analysis windows per record for a multi-channel analysis.

Start time (ms) — Enter the start time of the window to use.

Length (ms) — Enter the length of the window to use.

Apply moveout – Specify whether a linear moveout will be applied to the start time of the analysis window.

Velocity – If moveout is to be applied, specify the moveout velocity.

Output Header – Select the trace header that will be updated with the results of the analysis.

Amplitude Spectrum

Usage:

The Amplitude Spectrum step inputs seismic data and outputs the amplitude spectrum of each trace into the output seismic file.

Input Links:

1) Seismic data in any order (mandatory).

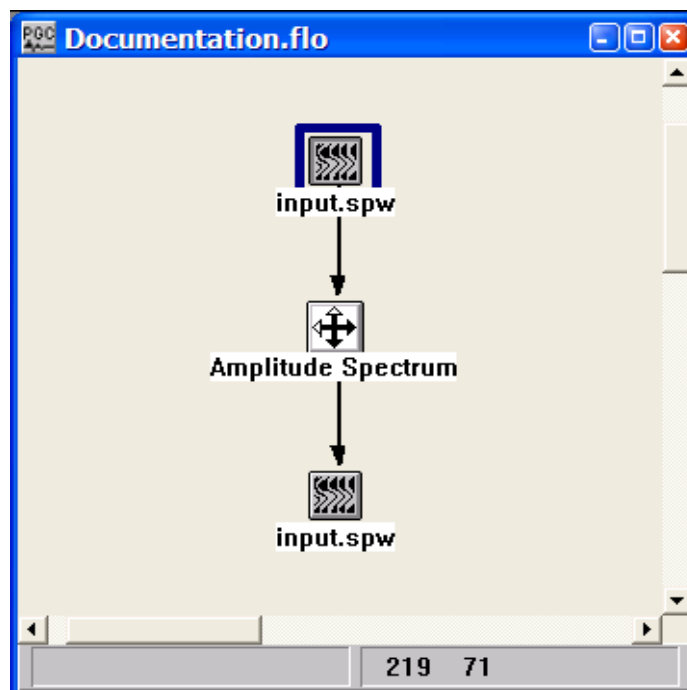
Output Links:

1) Seismic data amplitude spectrum attribute traces (mandatory).

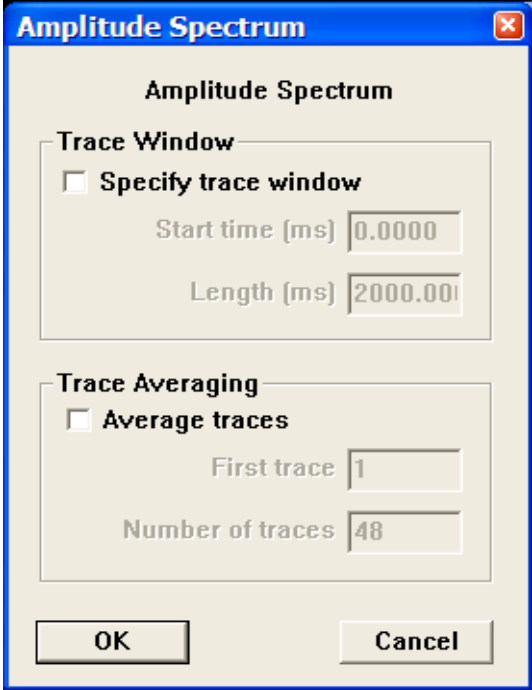
References:

See Technical Note TN-AmpSpc.doc

Example Flowchart:



Step Parameter Dialog:



The image shows a dialog box titled "Amplitude Spectrum". It contains two main sections: "Trace Window" and "Trace Averaging". In the "Trace Window" section, there is a checkbox labeled "Specify trace window" which is currently unchecked. Below this checkbox are two input fields: "Start time (ms)" with the value "0.0000" and "Length (ms)" with the value "2000.000". In the "Trace Averaging" section, there is a checkbox labeled "Average traces" which is also unchecked. Below this checkbox are two input fields: "First trace" with the value "1" and "Number of traces" with the value "48". At the bottom of the dialog box are two buttons: "OK" and "Cancel".

Parameter Description:

Specify Trace Window — If checked, the specified window will be used for calculating the amplitude spectrum.

Start time (ms) — Enter the start time of the window to use.

Length (ms) — Enter the length of the window to use.

Average Traces — If checked, the spectrums of the specified traces will be averaged.

First trace — Enter the first trace number in the window to be average.

Number of traces — Enter the number of traces to average.

Autocorrelation

Usage:

The Autocorrelation computes a single trace autocorrelation for each input data trace. The autocorrelation trace will have the same length as the input trace, and the zero lag value can be shift in time if you want to view both positive and negative lags.

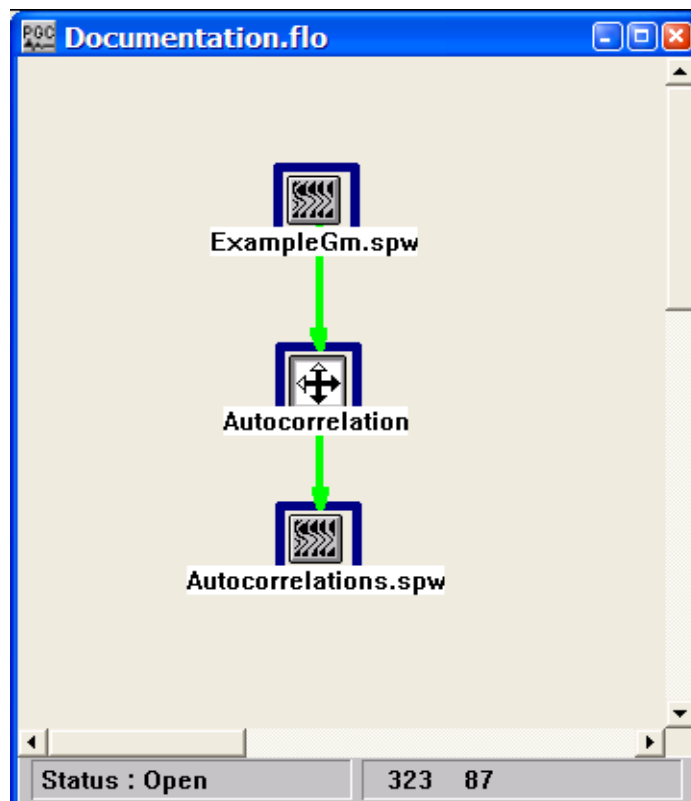
Input Links:

1) Seismic data in any sort order (mandatory).

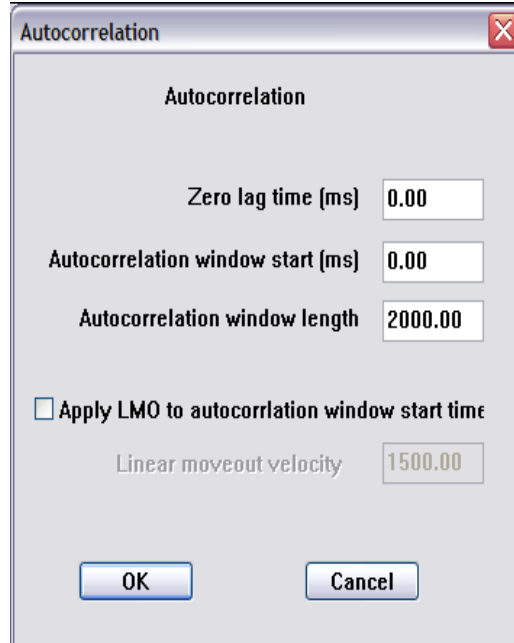
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Autocorrelation". It contains several input fields and a checkbox. The "Zero lag time (ms)" field is set to 0.00. The "Autocorrelation window start (ms)" field is set to 0.00. The "Autocorrelation window length" field is set to 2000.00. There is a checkbox labeled "Apply LMO to autocorrelation window start time" which is currently unchecked. Below this checkbox is a field for "Linear moveout velocity" set to 1500.00. At the bottom of the dialog are "OK" and "Cancel" buttons.

Parameter	Value
Zero lag time (ms)	0.00
Autocorrelation window start (ms)	0.00
Autocorrelation window length	2000.00
Apply LMO to autocorrelation window start time	<input type="checkbox"/>
Linear moveout velocity	1500.00

Parameter Description:

Zero lag time (ms) — Enter the time to display the zero lag value of the autocorrelation. If the value is zero, only the positive lags will be computed. If the value is equal to half the input trace length, a fully symmetric autocorrelation will be output.

Autocorrelation window start (ms) — Enter the start time in milliseconds for computing the trace autocorrelation.

Autocorrelation window length (ms) — Enter the length in milliseconds for computing the trace autocorrelation. The autocorrelation function will be generated from data samples between the start time and the start time + window length.

Apply LMO to autocorrelation window start time — If checked, the autocorrelation window start time will be a function of offset:

$$\text{Start time} = (\text{source-receiver offset} / \text{velocity}) + \text{Autocorrelation window start time.}$$

Compare Traces

Usage:

The Compare Traces step allows you to compare two seismic data files and determine if they are identical within a user-specified tolerance. The results of the comparison are written to the console and the numeric differences of each trace are written to the output seismic file.

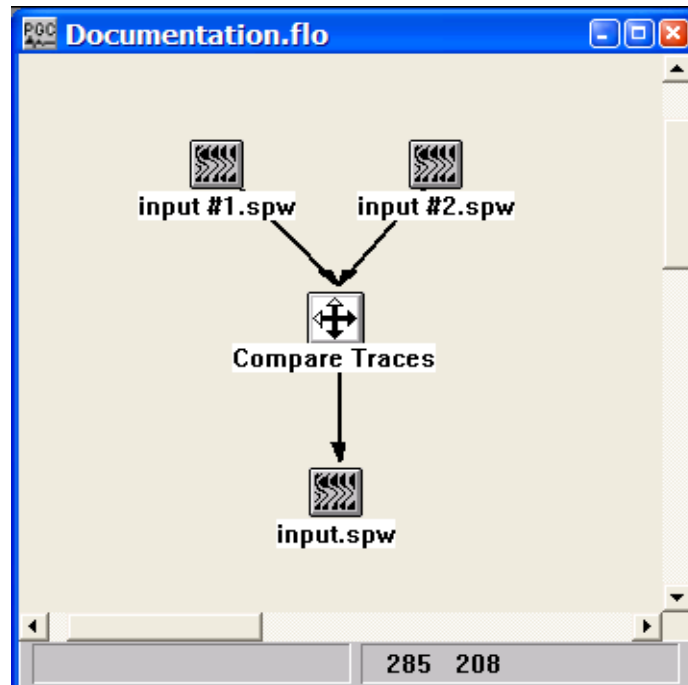
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in the same sort order as input link #1 (mandatory).

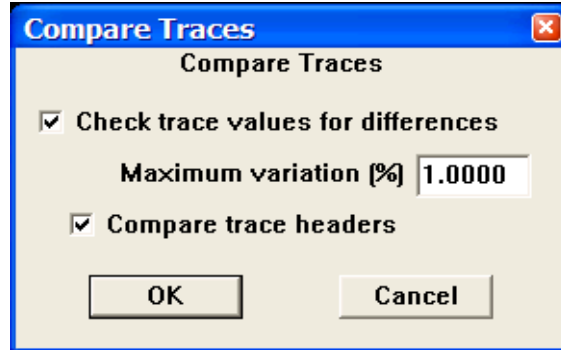
Output Links:

- 1) Seismic data in the same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Check trace values for differences — If checked, the two input seismic trace data sets will be compared sample by sample and checked against the maximum allowed percent variation that is entered.

Max % variation — Enter the maximum allowable percentage variation for differences in the trace sample values.

Compare Trace Headers — If checked, the trace header fields for the data traces with are compared and a failure will occur if they do not match exactly.

Cross Correlation

Usage:

The Cross Correlation step computes the cross correlation function for each pair of corresponding input data traces. The length of the cross correlation trace is $2n - 1$ samples, where n is the number of samples in each of the input data traces. The zero lag value of the cross correlation trace occurs at sample n .

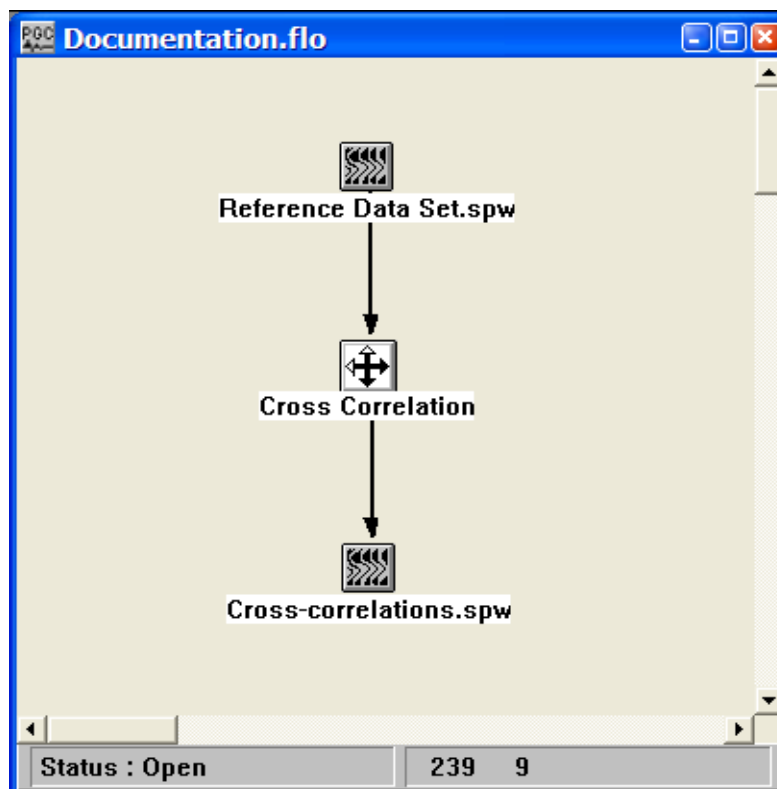
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order (mandatory).

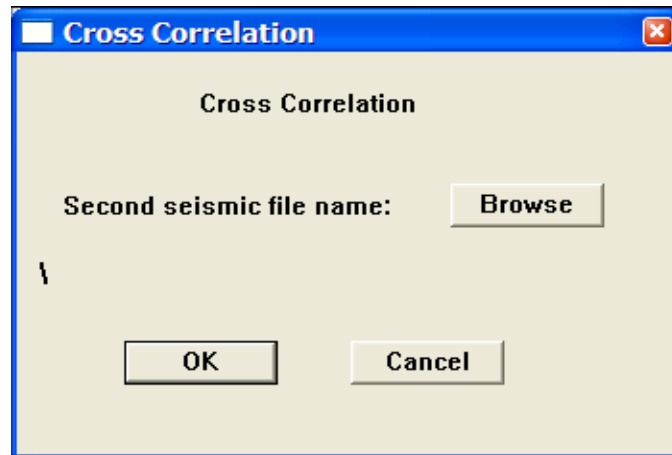
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Second seismic file name – Use the Browse button to select the seismic file that will be cross-correlated with the input reference seismic file.

Extract Dead Traces

Usage:

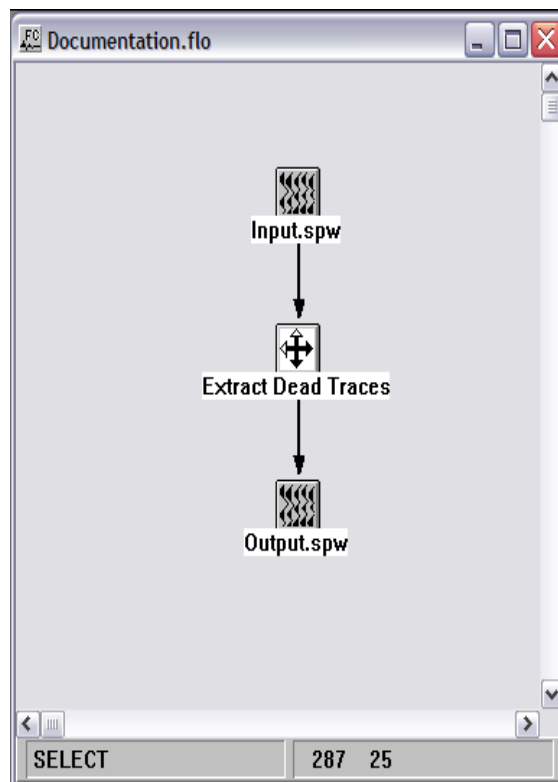
The Extract Dead Traces step removes traces with a dead trace flag from the data stream prior to output.

Input Links:

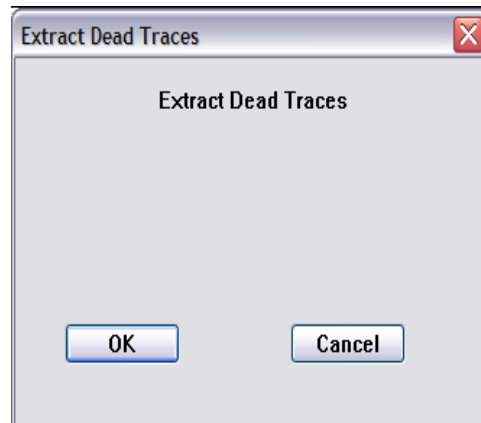
1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:



Parameter Description:

There are no parameters for the Extract Dead Traces step

F-T Cube

Usage:

The Frequency-Time Cube step converts a 2D seismic line into 3D F-T volume whose axis are CMP Location, Frequency, and Time.

Input Links:

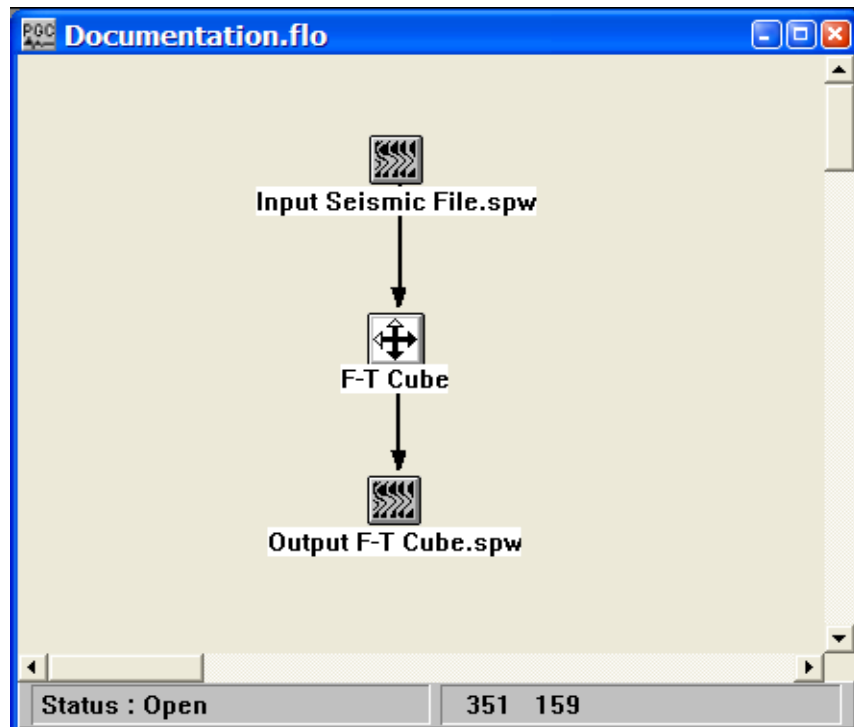
1) Seismic data in any sort order (mandatory).

Output Links:

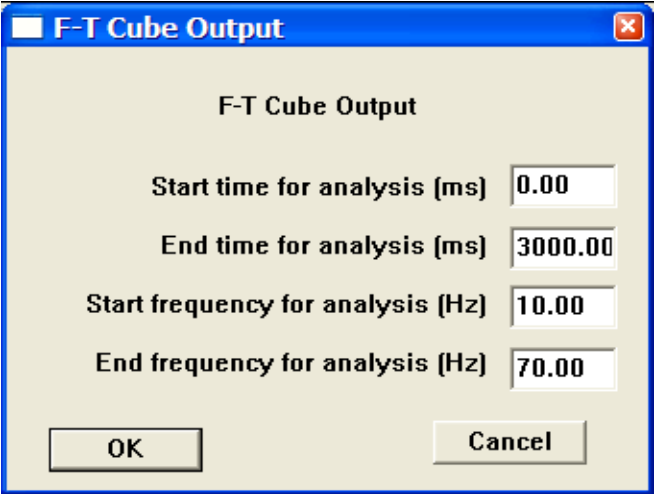
1) F-T Cube (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "F-T Cube Output". It has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. Inside, the title "F-T Cube Output" is centered. Below the title, there are four rows of labels and text input fields. The first row is "Start time for analysis (ms)" with the value "0.00". The second row is "End time for analysis (ms)" with the value "3000.00". The third row is "Start frequency for analysis (Hz)" with the value "10.00". The fourth row is "End frequency for analysis (Hz)" with the value "70.00". At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right.

F-T Cube Output	
Start time for analysis (ms)	0.00
End time for analysis (ms)	3000.00
Start frequency for analysis (Hz)	10.00
End frequency for analysis (Hz)	70.00
OK Cancel	

Parameter Description:

Start time for analysis (ms) — Enter the start time of the F-T cube.

End time for analysis (ms) — Enter the end time of the F-T cube.

Start frequency for analysis (Hz) — Enter the value of the first frequency slice to output.

End frequency for analysis (Hz) — Enter the value of the last frequency slice to output.

F-T Frequency Slice

Usage:

The Frequency-Time Frequency Slice step converts each trace in a data set into an F-T data set then outputs the selected constant frequency slices.

Input Links:

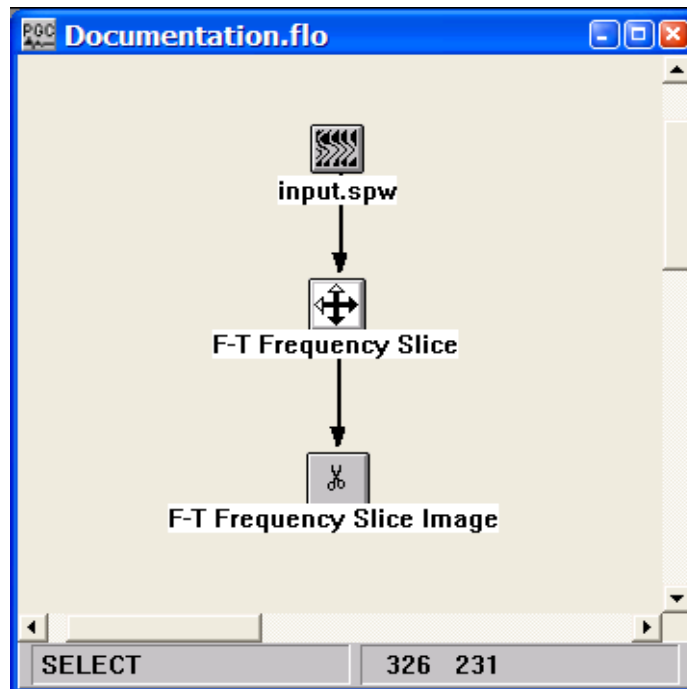
1) Seismic data in any sort order (mandatory).

Output Links:

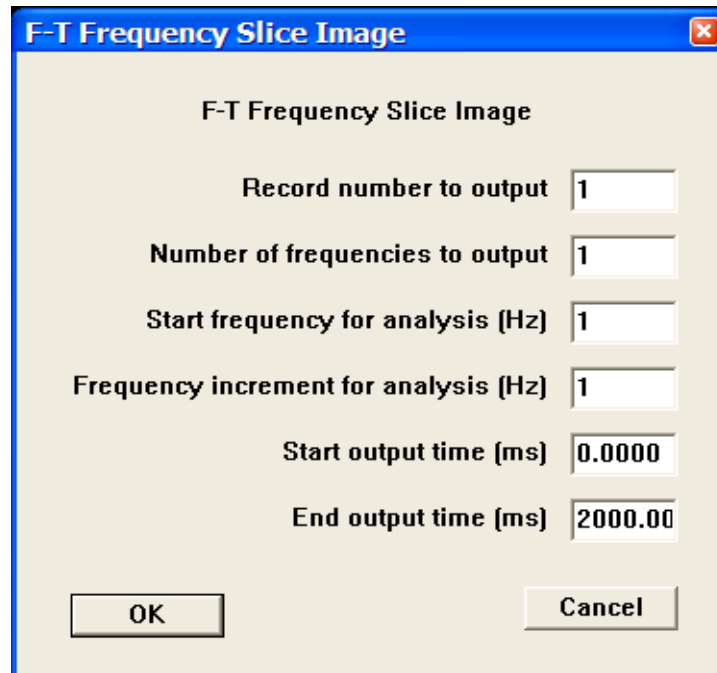
1) F-T Frequency Slice Image (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "F-T Frequency Slice Image". It has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. Inside, there are six labels with corresponding text input fields:

- Record number to output**: Input field contains "1".
- Number of frequencies to output**: Input field contains "1".
- Start frequency for analysis (Hz)**: Input field contains "1".
- Frequency increment for analysis (Hz)**: Input field contains "1".
- Start output time (ms)**: Input field contains "0.0000".
- End output time (ms)**: Input field contains "2000.00".

At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right, both with a standard 3D button appearance.

Parameter Description:

Record number to output — Enter the record number to use in the calculation.

Number of frequencies to output — Enter the number of frequency slices to output.

Start frequency for analysis — Enter the frequency in Hertz of the first slice to output.

Frequency increment for analysis — Enter the increment in Hertz between output slices.

Start output time — Enter the first time to use in the output.

End output time — Enter the last time to use in the output.

F-T Time Slice

Usage:

The Frequency-Time Time Slice step converts each trace in a data set into an F-T data set then outputs the selected constant time slices.

Input Links:

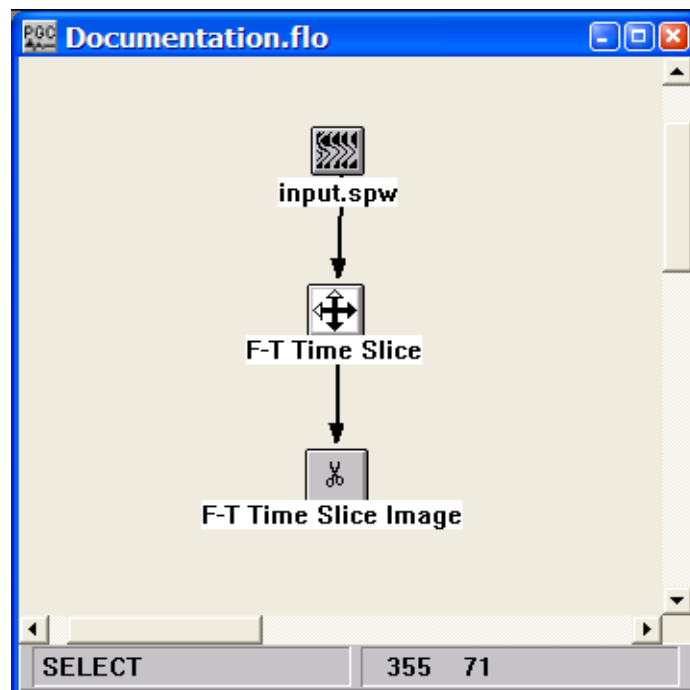
1) Seismic data in any sort order (mandatory).

Output Links:

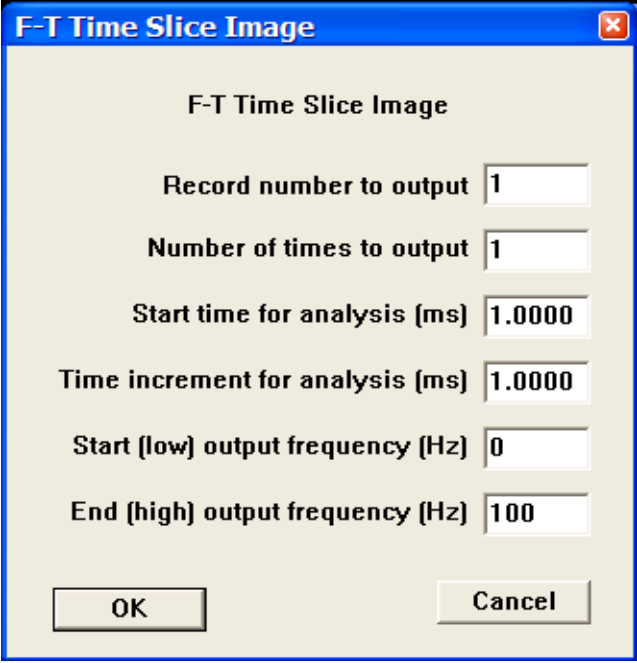
1) F-T Time Slice Image (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "F-T Time Slice Image". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige and contains six input fields, each with a label to its left. The labels are: "Record number to output", "Number of times to output", "Start time for analysis (ms)", "Time increment for analysis (ms)", "Start (low) output frequency (Hz)", and "End (high) output frequency (Hz)". The input fields contain the values: 1, 1, 1.0000, 1.0000, 0, and 100 respectively. At the bottom of the dialog are two buttons: "OK" on the left and "Cancel" on the right.

Parameter	Value
Record number to output	1
Number of times to output	1
Start time for analysis (ms)	1.0000
Time increment for analysis (ms)	1.0000
Start (low) output frequency (Hz)	0
End (high) output frequency (Hz)	100

Parameter Description:

Record number to output — Enter the record number to use in the calculation.

Number of times to output — Enter the number of time slices to output.

Start time for analysis (ms) — Enter the time in milliseconds of the first slice to output.

Time increment for analysis (ms) — Enter the increment in milliseconds between output slices.

Start (low) output frequency (Hz) — Enter the first frequency in Hertz to use in the output.

End (high) output frequency (Hz) — Enter the last frequency in Hertz to use in the output.

Frequency Analysis

Usage:

The Frequency Analysis step performs single- or multi-channel spectral analysis of sample amplitudes and updates a user specified trace header with the results of the analysis. Analysis types include Dominant Frequency, Peak Amplitude at dominant frequency, Bandwidth, Average Frequency, Spectral Kurtosis, and Spectral Power.

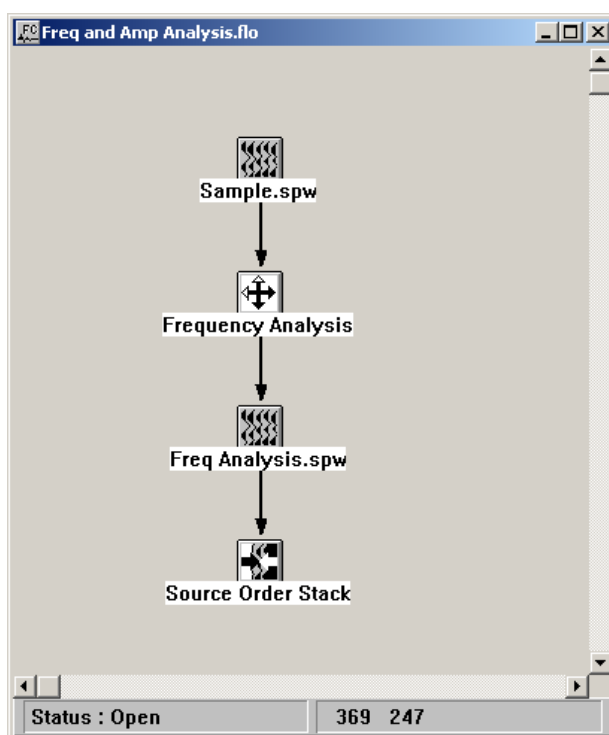
Input Links:

1) Seismic data in any order (mandatory).

Output Links:

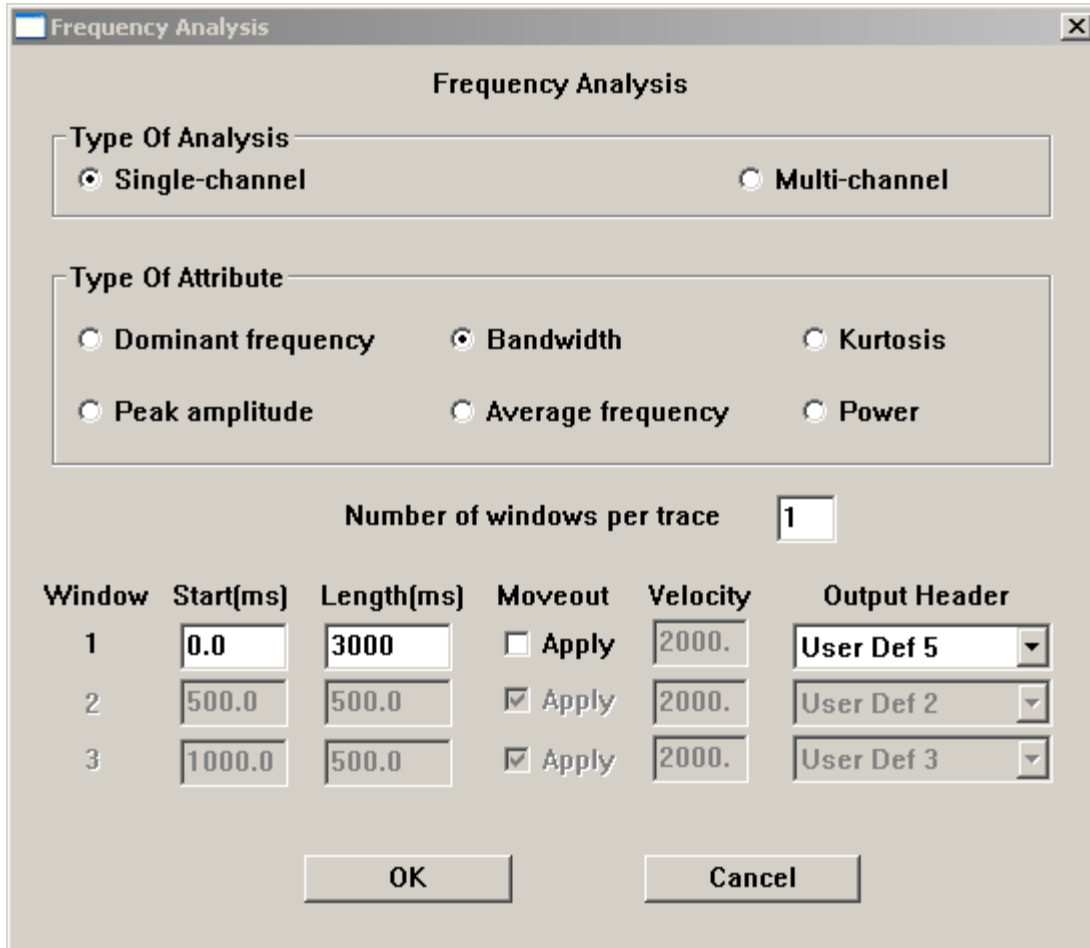
1) Seismic data amplitude spectrum attribute traces (mandatory).

Example Flowchart:



Note – The Stacking steps such as the Source Order Stack shown here will average the User Defined trace header fields where the attribute information is usually stored. This is a very useful feature as it very simply enables the calculation and display of the average attribute values for sources and receivers.

Step Parameter Dialog:



The dialog box is titled "Frequency Analysis". It contains two main sections: "Type Of Analysis" and "Type Of Attribute".

Type Of Analysis: Two radio buttons are present: "Single-channel" (selected) and "Multi-channel".

Type Of Attribute: Six radio buttons are arranged in two rows: "Dominant frequency", "Bandwidth" (selected), "Kurtosis", "Peak amplitude", "Average frequency", and "Power".

Number of windows per trace: A text box containing the value "1".

Table: A table with 6 columns: Window, Start(ms), Length(ms), Moveout, Velocity, and Output Header. It contains 3 rows of data.

Window	Start(ms)	Length(ms)	Moveout	Velocity	Output Header
1	0.0	3000	<input type="checkbox"/> Apply	2000.	User Def 5
2	500.0	500.0	<input checked="" type="checkbox"/> Apply	2000.	User Def 2
3	1000.0	500.0	<input checked="" type="checkbox"/> Apply	2000.	User Def 3

At the bottom are "OK" and "Cancel" buttons.

Parameter Description:

Type of Analysis — Specify whether the amplitude analysis will be single-channel or multi-channel. Single-channel attributes are calculated per trace. Multi-channel attributes are calculated from the ensemble of traces in an input gather.

Type of Attribute — Specify the type of amplitude attribute.

Dominant frequency – Calculate the the dominant frequency in the analysis window.

Peak amplitude – Determine the amplitude of the dominant frequency in the analysis window.

Bandwidth – Calculate the bandwidth of the frequency spectrum assuming Gaussian statistics. The width of the 1st standard deviation is calculated.

Average frequency – Calculate the average frequency in the analysis window.

Kurtosis – A statistical measure of the sharpness vs flatness of the frequency spectrum.

Power – Calculate the sum of the squares of spectral amplitudes in the analysis window.

Number of windows per trace — Specify the number of analysis windows per trace for a single-channel analysis, or the number of analysis windows per record for a multi-channel analysis.

Start time (ms) — Enter the start time of the window to use.

Length (ms) — Enter the length of the window to use.

Apply moveout – Specify whether a linear moveout will be applied to the start time of the analysis window.

Velocity – If moveout is to be applied, specify the moveout velocity.

Output Header – Select the trace header that will be updated with the results of the analysis.

Gabor Transform

Usage:

The Gabor Transform step performs spectral decomposition of the seismic trace data using the Gabor transform-like multifilter analysis technique. The number frequency traces in each time-frequency gather is equal to:

$$\text{Number of traces} = (\text{EndFrequency} - \text{Start Frequency}) / \text{Filter Bandwidth traces}$$

Each trace in the time-frequency gather represents a different frequency band in the original data.

Input Links:

1) Seismic data in any order (mandatory).

Output Links:

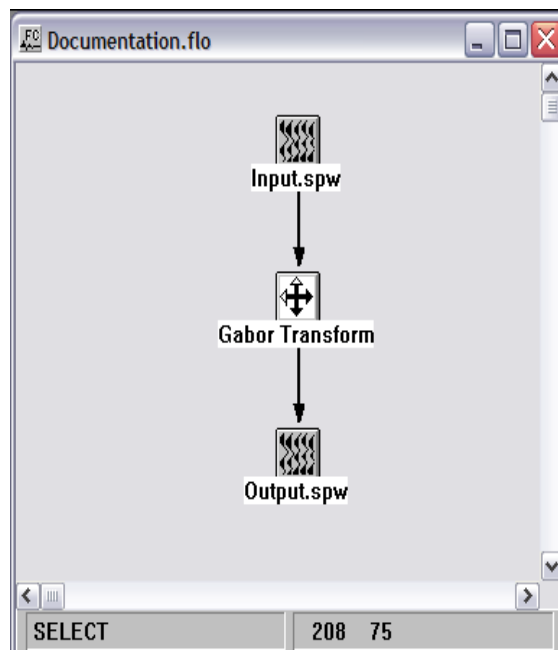
1) Seismic data in any order (mandatory).

References

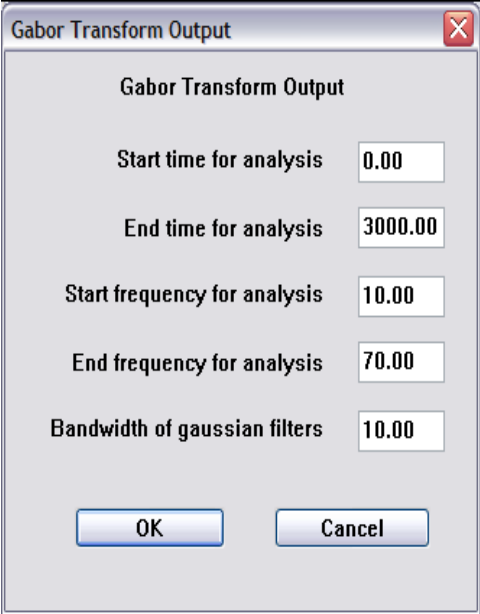
Dziewonski, Bloch, and Landisman, 1969, A technique for the analysis of transient seismic signals, Bull. Seism. Soc. Am., 1969, vol. 59, no.1, pp.427-444.

Taner, M., T., Koehler, F., and Sheriff, R., E., 1979, Complex seismic trace analysis, Geophysics, vol. 44, pp.1041-1063.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Gabor Transform Output". It contains five input fields for parameters: "Start time for analysis" (0.00), "End time for analysis" (3000.00), "Start frequency for analysis" (10.00), "End frequency for analysis" (70.00), and "Bandwidth of gaussian filters" (10.00). At the bottom are "OK" and "Cancel" buttons.

Gabor Transform Output	
Start time for analysis	0.00
End time for analysis	3000.00
Start frequency for analysis	10.00
End frequency for analysis	70.00
Bandwidth of gaussian filters	10.00

Parameter Description:

Start time for analysis — Specify the start time for time-frequency analysis.

End time for analysis — Specify the end time for time-frequency analysis.

Start frequency for analysis — Specify the start frequency for time-frequency analysis.

End frequency for analysis — Specify the end frequency for time-frequency analysis.

Bandwidth of Gaussian — Specify the bandwidth of each frequency analysis.

Instantaneous Amplitude

Usage:

The Instantaneous Amplitude step calculates instantaneous amplitude attributes for each trace and outputs each as a seismic trace in the output seismic file. Instantaneous amplitude is a measure of the reflectivity strength of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

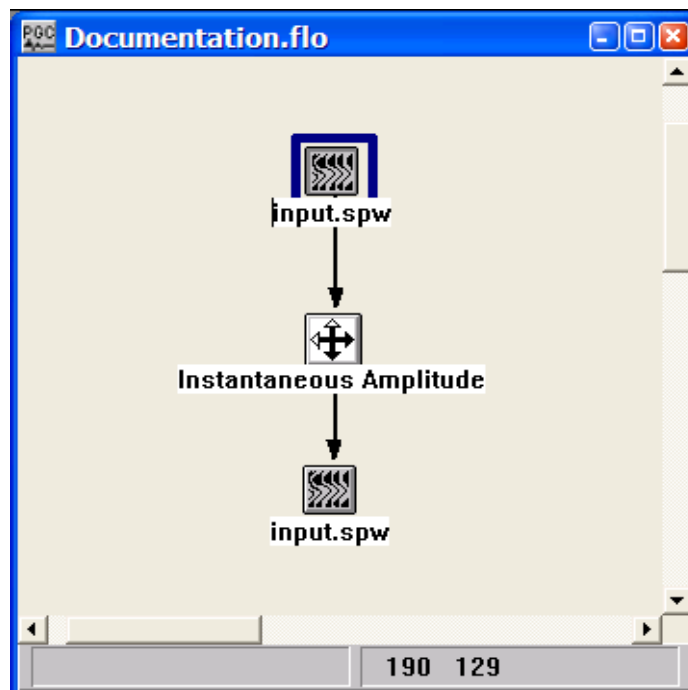
Output Links:

1) Seismic attribute data in any sort order (mandatory).

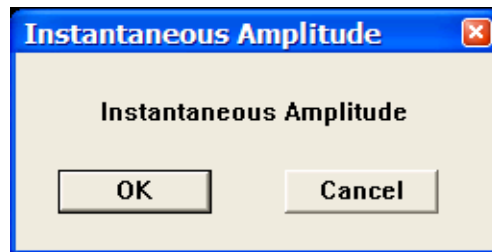
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Instantaneous Frequency

Usage:

The Instantaneous Frequency step calculates instantaneous frequency attribute for each trace and outputs each as a seismic trace in the output seismic file. This attribute is a measure of the frequency of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

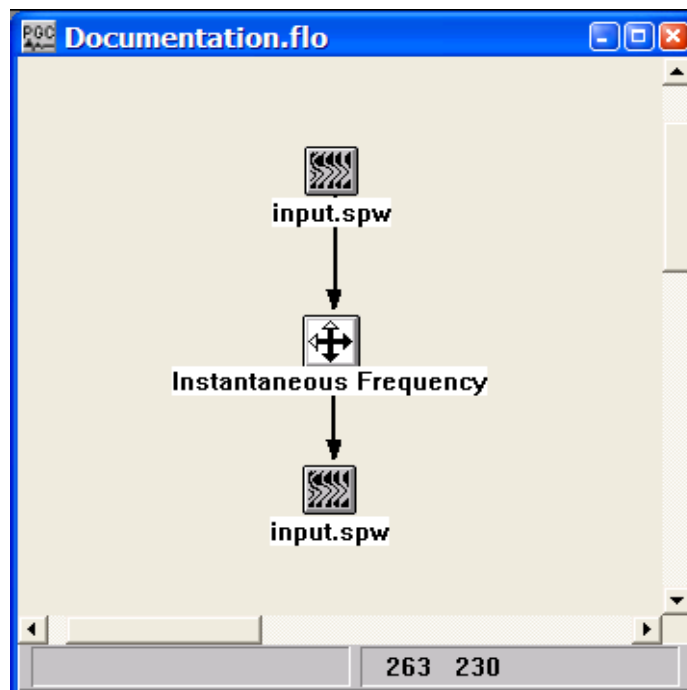
Output Links:

1) Seismic attribute data in any sort order (mandatory).

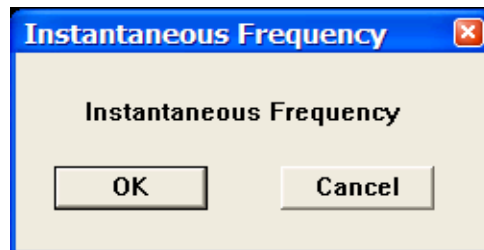
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Instantaneous Phase

Usage:

The Instantaneous Phase step calculates instantaneous phase attribute for each trace and outputs each as a seismic trace in the output seismic file. This attribute is a measure of the continuity of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

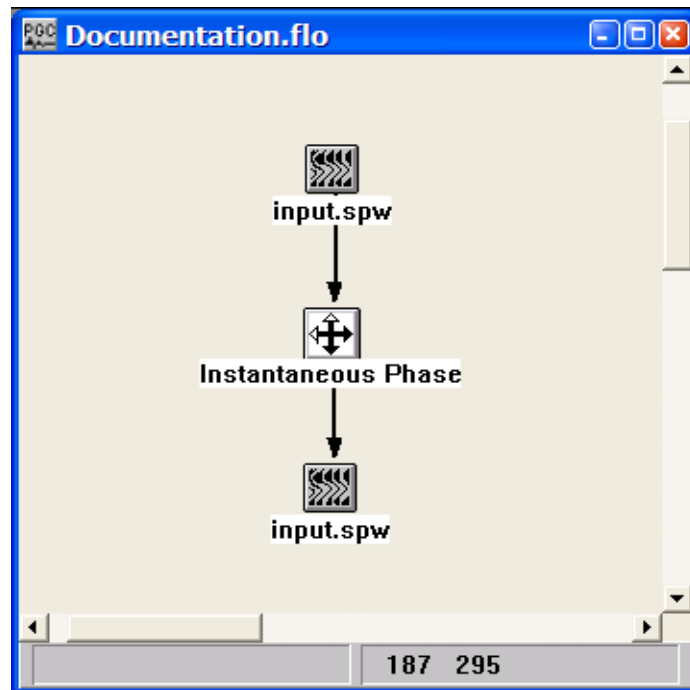
Output Links:

1) Seismic attribute data in any sort order (mandatory).

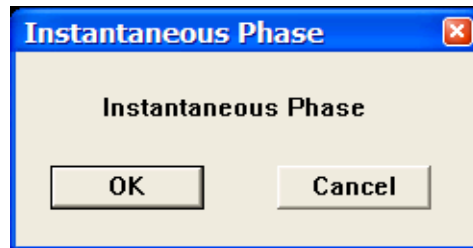
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Phase Matching

Usage:

The Phase Matching step computes the constant phase rotation and time shift between pairs of corresponding data traces contained in a reference and secondary data volume. The value of the average phase rotation and the average time shift between the two volumes is written to the execution console. The option exists to output the value of each phase rotation-time shift pair to a Phase Matching Statistics card data file.

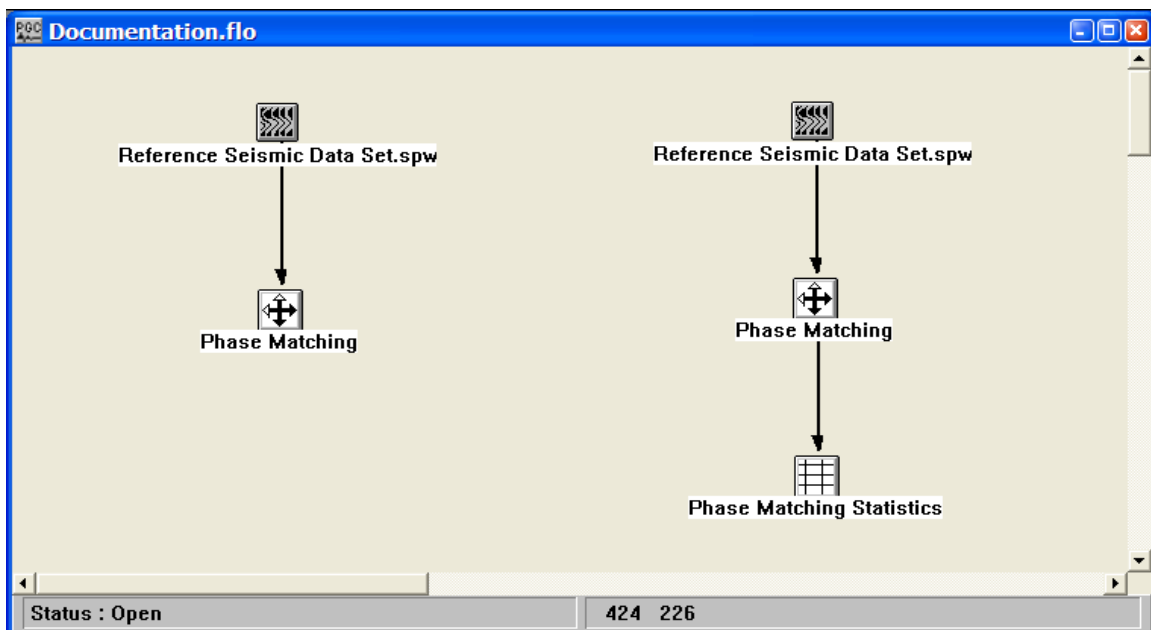
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order (mandatory).

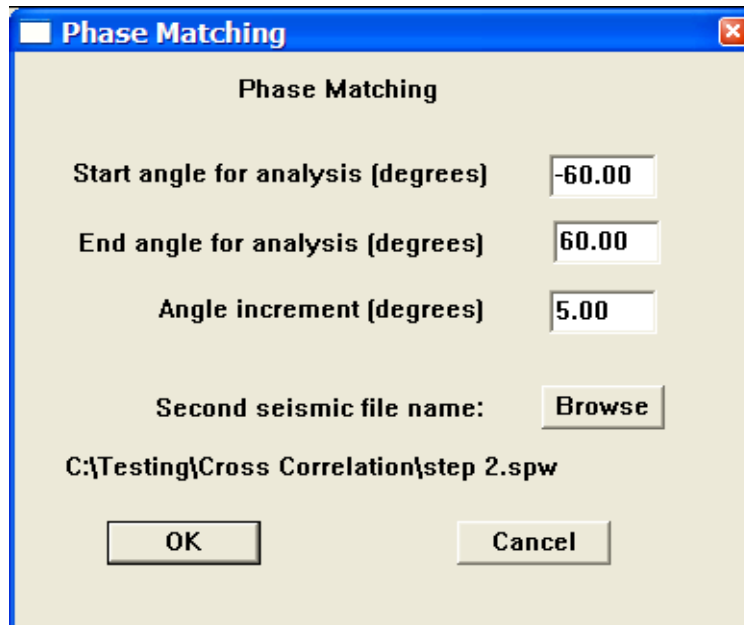
Output Links:

- 1) Phase Matching Statistics card data (optional).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Phase Matching". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. It contains four input fields with labels to their left: "Start angle for analysis (degrees)" with a value of "-60.00", "End angle for analysis (degrees)" with a value of "60.00", "Angle increment (degrees)" with a value of "5.00", and "Second seismic file name:" followed by a "Browse" button. Below these fields, the file path "C:\Testing\Cross Correlation\step 2.spw" is displayed. At the bottom, there are two buttons: "OK" and "Cancel".

Parameter	Value
Start angle for analysis (degrees)	-60.00
End angle for analysis (degrees)	60.00
Angle increment (degrees)	5.00
Second seismic file name:	Browse

C:\Testing\Cross Correlation\step 2.spw

OK Cancel

Parameter Description:

Start angle for analysis (degrees) – Enter the start angle used in the analysis. The step will analyze all angles from the Start angle to the End angle at increments specified by the Angle increment.

End angle for analysis (degrees) – Enter the end angle used in the analysis. The step will analyze all angles from the Start angle to the End angle at increments specified by the Angle increment.

Angle increment (degrees) – Enter the angle increment used in the analysis. The step will analyze all angles from the Start angle to the End angle at increments specified by the Angle increment.

Second seismic file name – Use the Browse button to select the seismic file that will be cross-correlated with the input reference seismic file.

Resolution

Usage:

The Resolution step provides a statistical estimate of the resolving power of the selected seismic data. The results of the process are output to the console file.

Input Links:

1) Seismic data in any sort order (mandatory).

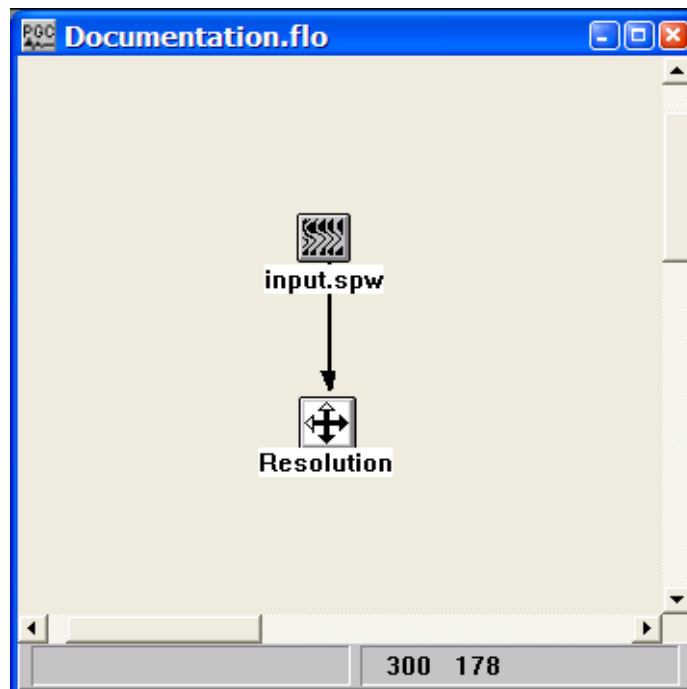
Output Links:

None – The results of the process are output to the console file.

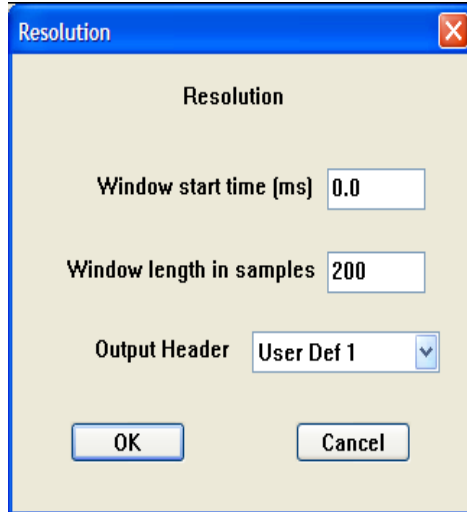
Reference:

Hatton, L., Worthington, M.H. and Makin, J. , Seismic Data Processing, Theory and Practice, 1986.

Example Flowchart:



Step Parameter Dialog:

A screenshot of a software dialog box titled "Resolution". The dialog has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. It contains three input fields: "Window start time (ms)" with a text box containing "0.0", "Window length in samples" with a text box containing "200", and "Output Header" with a dropdown menu showing "User Def 1". At the bottom are two buttons: "OK" and "Cancel".

Resolution

Resolution

Window start time (ms) 0.0

Window length in samples 200

Output Header User Def 1

OK Cancel

Parameter Description:

Window start time (ms) — Enter the starting time of the analysis window on the trace data.

Window length in samples — Enter the length of the analysis window in samples.

Output Header – Indicate the trace header field to store the results of the resolution calculation.

Signal to Noise

Usage:

The Signal to Noise step provides an statistical estimate of the signal to noise ratio of the selected seismic data. The results of the process are output to the console file.

Input Links:

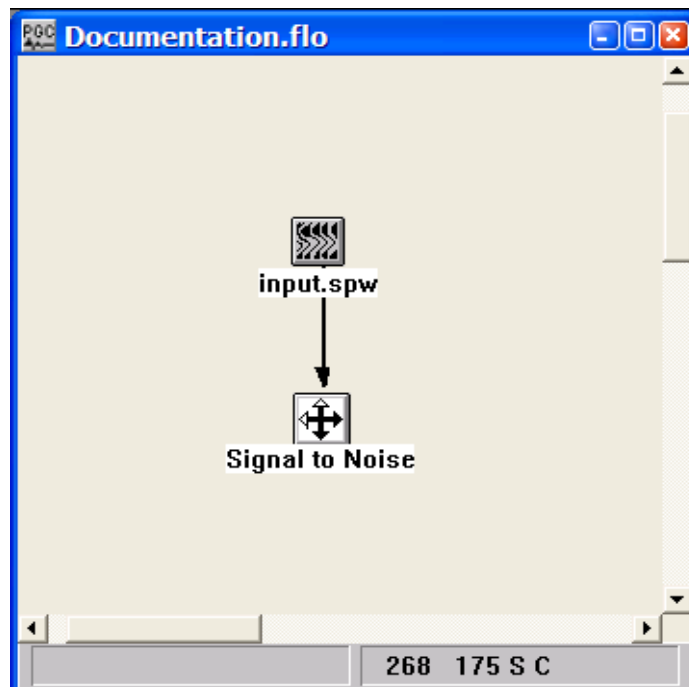
1) Seismic data in any sort order (mandatory).

Output Links:

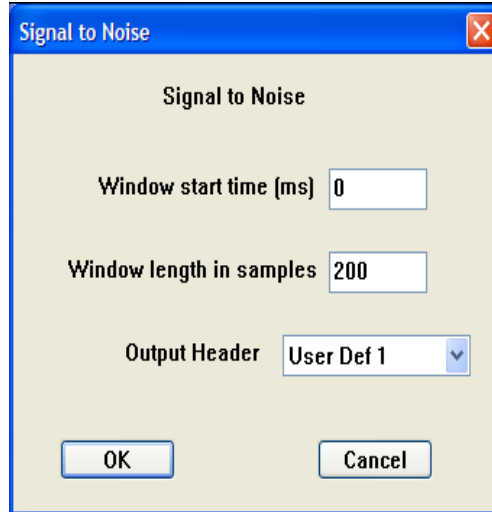
None – The results of the process are output to the console file.

Reference:

Hatton, L., Worthington, M.H. and Makin, J. , Seismic Data Processing, Theory and Practice, 1986.

Example Flowchart:

Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Signal to Noise". It has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. Inside, the text "Signal to Noise" is centered at the top. Below it, there are three input fields: "Window start time (ms)" with the value "0", "Window length in samples" with the value "200", and "Output Header" with a dropdown menu showing "User Def 1". At the bottom, there are two buttons: "OK" and "Cancel".

Parameter Description:

Window start time (ms) — Enter the starting time of the analysis window on the trace data.

Window length in samples — Enter the length of the analysis window in samples.

Output Header – Indicate the trace header field to store the results of the signal to noise calculation.

Source Energy Estimation

Usage:

The Source Energy Estimation computes an estimate of the source energy-to-noise ratio based on an analysis of samples values prior to and following the arrival of first break energy. A text file is output that contains, for each source location, an estimate of (1) the energy-to-noise ratio, (2) the average energy, and (3) the average noise

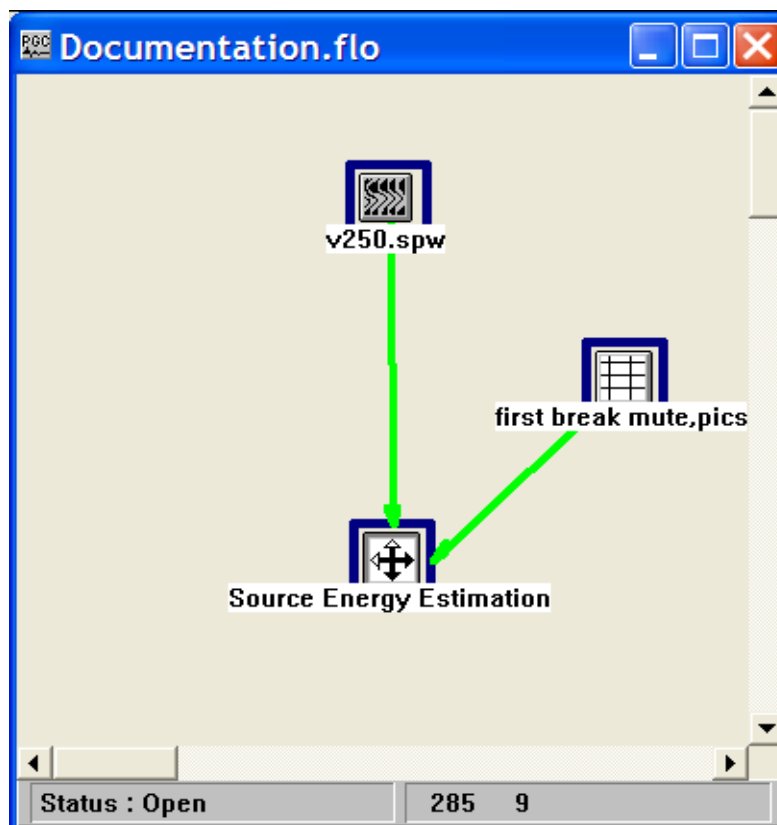
Input Links:

- 1) Seismic data in source order (mandatory).
- 2) An Early Mute card containing reference times to the start of analysis. Typically, these would be picked at the time of the first arrivals. (mandatory).

Output Links:

None. A text file of the source energy estimation is specified inside the step dialog.

Example Flowchart:



Step Parameter Dialog:

Shot Energy Estimation

Noise window specification

Start Time above Mute (ms)

Window length (samples)

Data window specification

Start Time Below Mute (ms)

Window length (samples)

Output Header

Output report disk file:

Parameter Description:

Noise window specification — Specify the window for the analysis of noise.

Start Time above mute (ms) – Specify the time above the mute to start the analysis.

Window length (samples) – Specify the number of samples used to determine the noise estimate.

Data window specification — Specify the window for the analysis of noise.

Start Time above mute (ms) – Specify the time above the mute to start the analysis.

Window length (samples) – Specify the number of samples used to determine the signal estimate.

Output report disk file — Specify the name of the text file (*.txt) that will contain the results of the analysis.

Output Header – Indicate the trace header field to store the results of the source-energy estimate.

Trace Analysis Report

Usage:

The Trace Analysis Report creates a text file that contains list bad records, and optionally, a list of traces that were killed in the geometry application step.

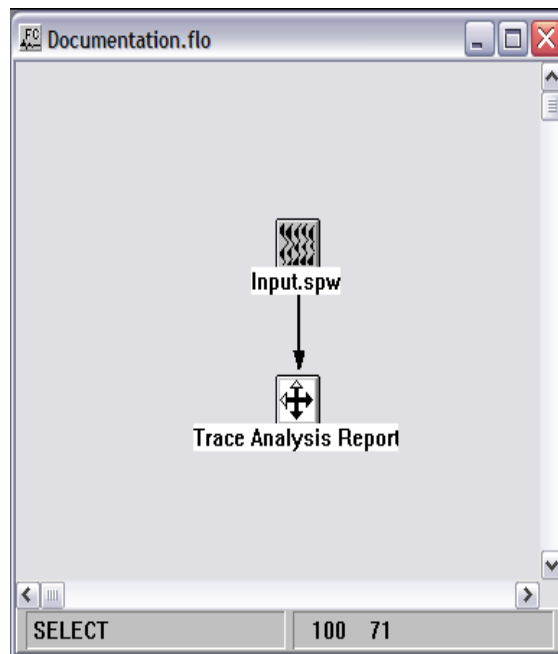
Input Links:

- 1) Seismic data in any sort order (mandatory).

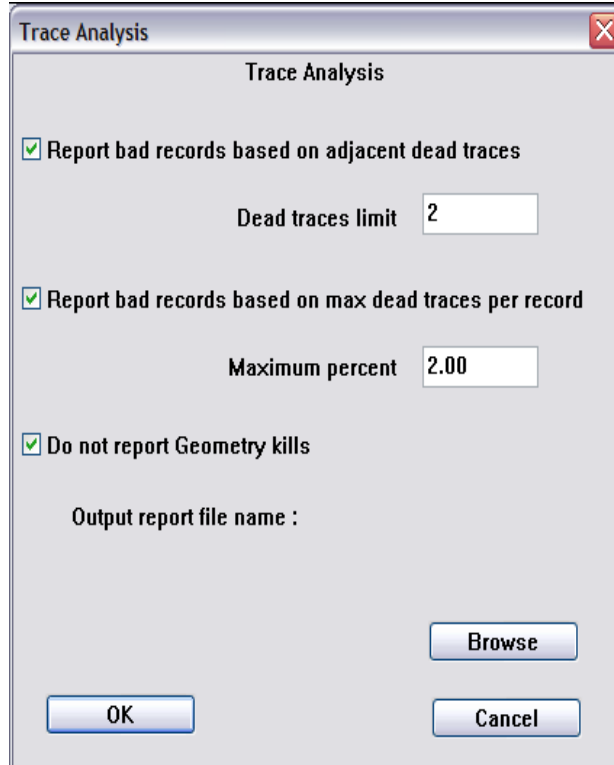
Output Links:

None. A text file for the trace report is specified inside the step dialog.

Example Flowchart:



Step Parameter Dialog:

The image shows a 'Trace Analysis' dialog box with a title bar containing the text 'Trace Analysis' and a close button (X). The dialog has a light gray background. It contains three checked checkboxes: 'Report bad records based on adjacent dead traces', 'Report bad records based on max dead traces per record', and 'Do not report Geometry kills'. Below the first checkbox is a text label 'Dead traces limit' followed by a text input field containing the value '2'. Below the second checkbox is a text label 'Maximum percent' followed by a text input field containing the value '2.00'. Below the third checkbox is a text label 'Output report file name :'. To the right of this label is a 'Browse' button. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Browse' (which is positioned to the right of the 'Output report file name' label).

Parameter Description:

Report bad records based on adjacent dead traces – Check this option if bad records are to be identified according to the number of adjacent dead traces.

Dead traces limit – Enter the number of adjacent dead traces that will cause the record to be considered “bad”, and therefore listed in the trace analysis report.

Report bad records based on max dead traces per record – Check this option if bad records are to be identified according to the number of adjacent dead traces.

Maximum percent – Enter the maximum percentage of dead traces that will cause the record to be considered “bad”, and therefore listed in the trace analysis report.

Do not report Geometry Kills – Check this option if you DO NOT want traces killed in the geometry application step to appear in the trace analysis report.

Output report file name – Use the Browse... button to assign a file name to the trace analysis report.

Trace Header Maps

Usage:

The Trace Header Maps step is used to create image files from the trace header values in 3D seismic data .

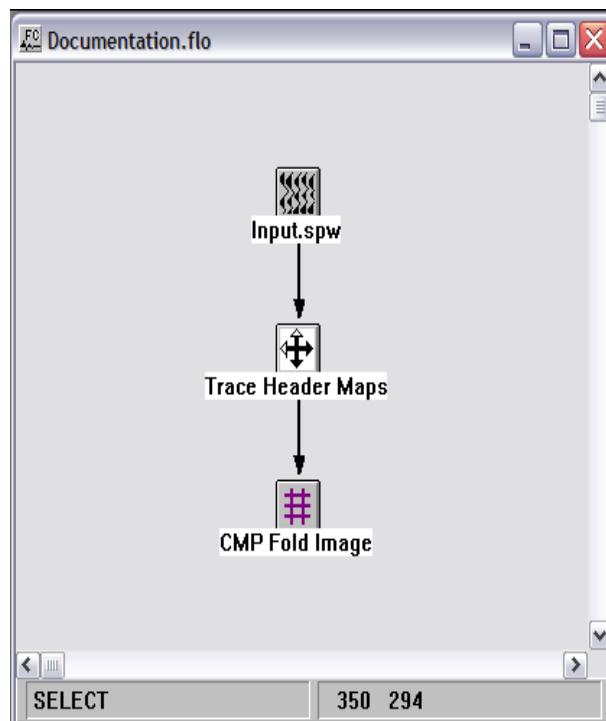
Input Links:

1) Seismic data in any sort order (mandatory).

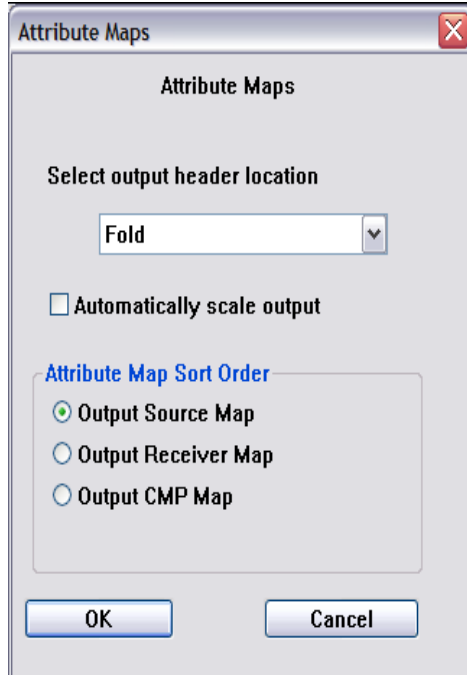
Output Links:

1) CMP Fold Image (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

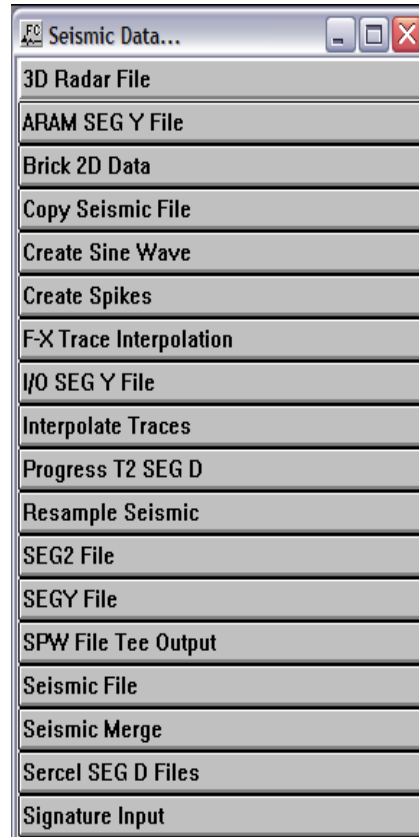
Select output header field – Use the drop down menu to select the trace header field that will be mapped into the CMP Fold Image.

Automatically scale output –

Attribute Map Sort Order – Select the output coordinate system – source, receiver, or CMP - for the image.

Seismic Data

This section documents the seismic data types in SPW and the processes currently available for creating those data types.



3D Radar File

Usage:

The 3D Radar File step is for the direct input of GPR data recorded in the 3D Radar format.

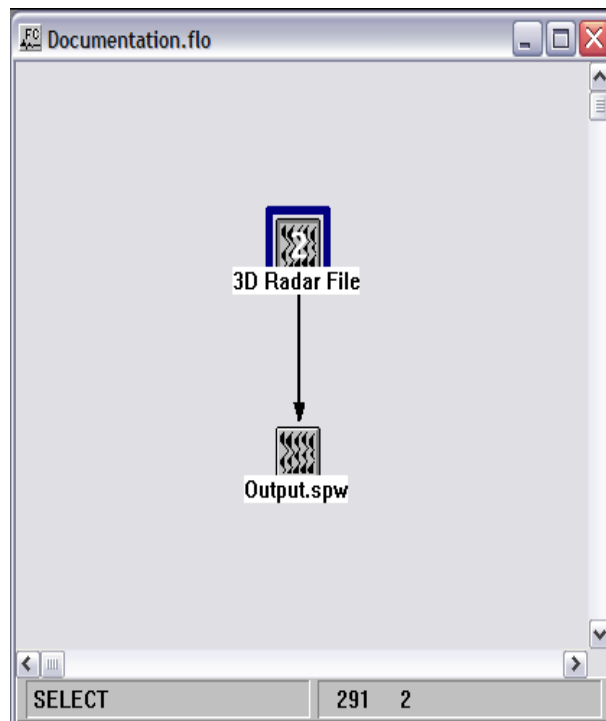
Input Links:

1) None. The radar file is selected inside the step dialog (mandatory).

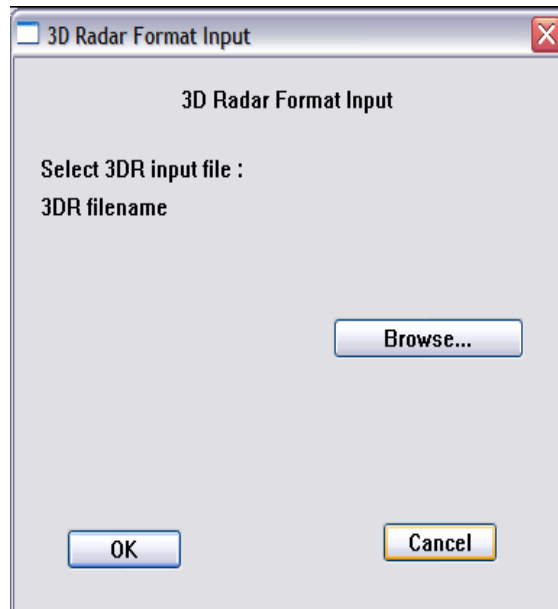
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Select 3DR input file — Use the Browse button to locate the 3D Radar formatted file to be reformatted on input.

ARAM SEG Y File

Usage:

The ARAM SEG Y File step is for the direct input of SEG Y data recorded with an ARAM Aries recording instrument.

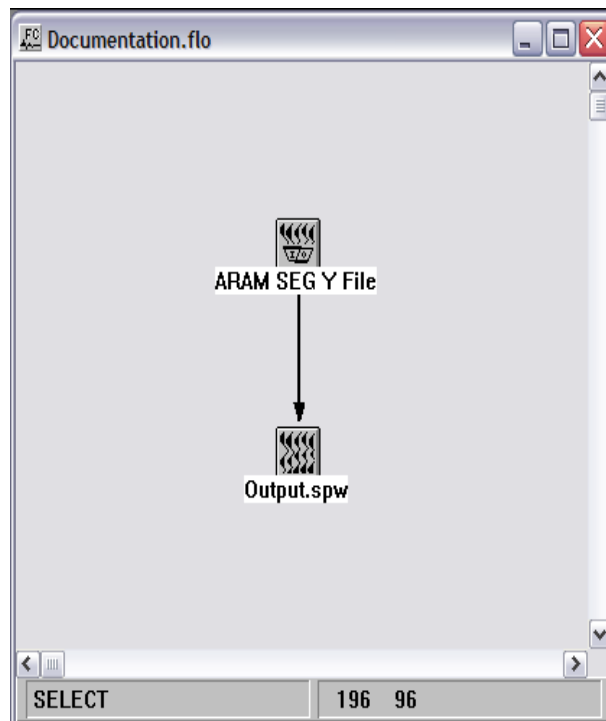
Input Links:

1) None. The ARAM SEG Y file is selected inside the step dialog (mandatory).

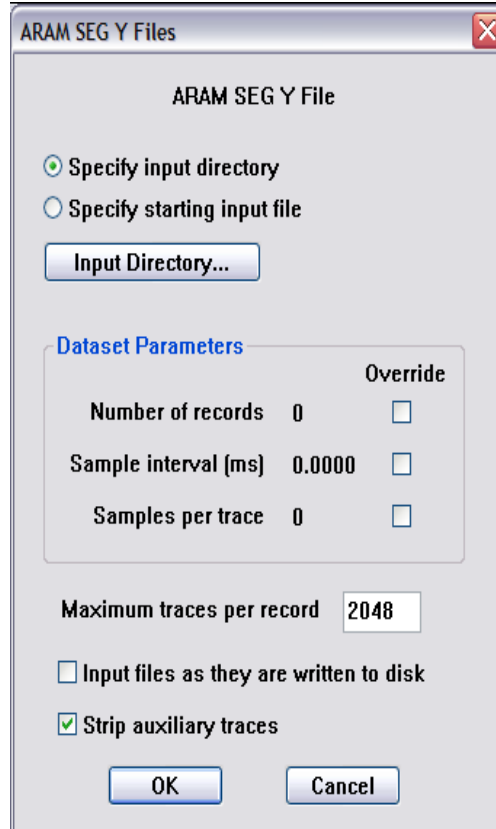
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "ARAM SEG Y Files" and contains the following elements:

- ARAM SEG Y File**
 - ☒ Specify input directory
 - ☐ Specify starting input file
 -
- Dataset Parameters**

		Override
Number of records	0	<input type="checkbox"/>
Sample interval (ms)	0.0000	<input type="checkbox"/>
Samples per trace	0	<input type="checkbox"/>
- Maximum traces per record:
- ☐ Input files as they are written to disk
- ☒ Strip auxiliary traces
-

Parameter Description:

Specify input directory — With the radio button set to Specify input directory, the browse button toggles to Input Directory... Use the Input Directory button to specify the folder where the SEG Y files are located.

Specify starting input file — With the radio button set to Specify starting input file, the browse button toggles to First Input File... Use the First Input File button to specify the first SEG Y file, located inside the Input Directory, to be reformatted.

Number of records — By default, all records will be reformatted. Check the override box to specify the number of records, starting with the first input file.

Sample interval (ms) — By default the sample interval will be extracted from the binary header. If that value is absent or incorrect, check the override box and specify a sample interval in milliseconds.

Samples per trace — By default the number of samples per trace will be extracted from the binary header. If that value is absent or incorrect, check the override box and specify a the number of samples per trace

Brick 2D Data

Usage:

The Brick 2D Data step was design to modify the manner in which closely spaced 2D profiles – GPR or seismic - were stored on disk so that they could be view as time slices.

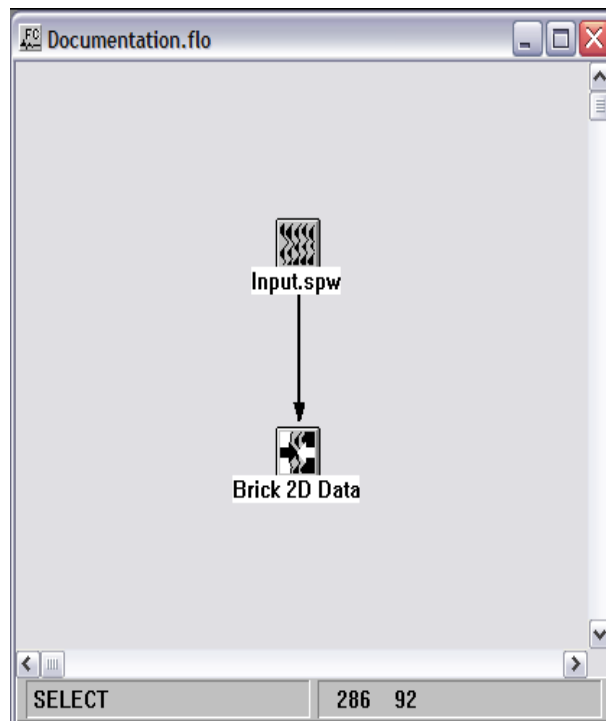
Input Links:

1) Post-stack seismic data in inline order (mandatory).

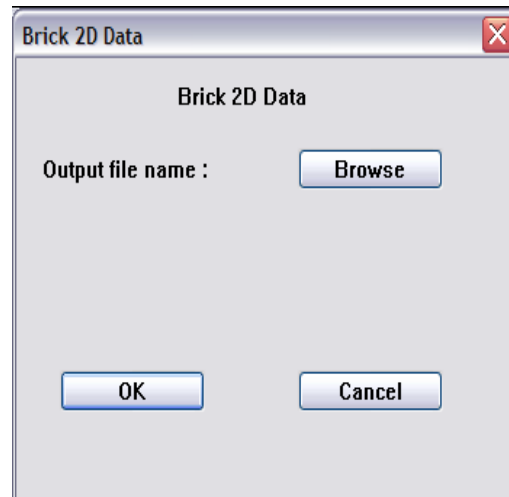
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Output file name — Assign a file name for the bricked data file.

Copy Seismic File

Usage:

The Copy Seismic File step allows you to copy a portion of a seismic data file into a separate seismic file.

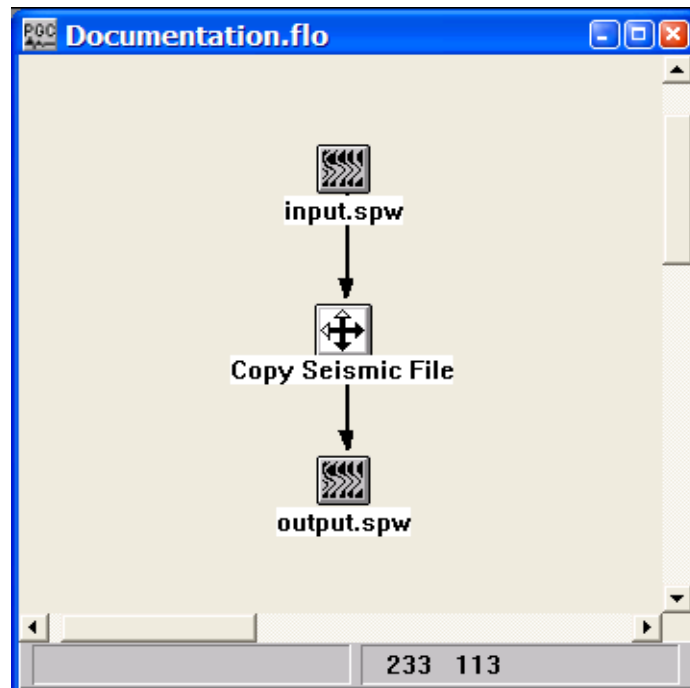
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Copy Seismic File

Copy Seismic File

Number of Traces per Record

☐ Limit traces per record output

No. of first trace

Traces per record

Trace increment

Azimuth Range...

OK **Cancel**

Azimuth Range

Azimuth Range

☐ Limit by azimuth

Raypaths In Azimuth Range

☐ Uni-directional

☒ Bi-directional

Starting azimuth (deg)

Azimuth range (deg)

Azimuths to output:

40.00 to 50.00 deg

220.00 to 230.00 deg

OK **Cancel**

Parameter Description:

Limit traces per record output — If checked, the output records will be limited by the specified parameters.

No. of first trace — Enter the first trace to output per record.

Traces per record — Enter the number of traces per record to be output.

Traces increment — Enter the increment between traces in the record to be output.

Azimuth Range Dialog -

Limit by azimuth — If checked, the azimuth range limiting parameters will be applied to the copy of the data.

Uni-directional — If selected, the azimuth range will include only angles in one direction.

Bi-directional — If selected, the azimuth range will include both positive and negative angles.

Starting azimuth (deg) — Enter the starting angle for your range in degrees.

Azimuth range (deg) — Enter the number of degrees from the starting angle to include in the range.

Azimuths to output — The dialog will indicate the azimuths that will be output as specified by the above parameters.

Create Sine Waves

Usage:

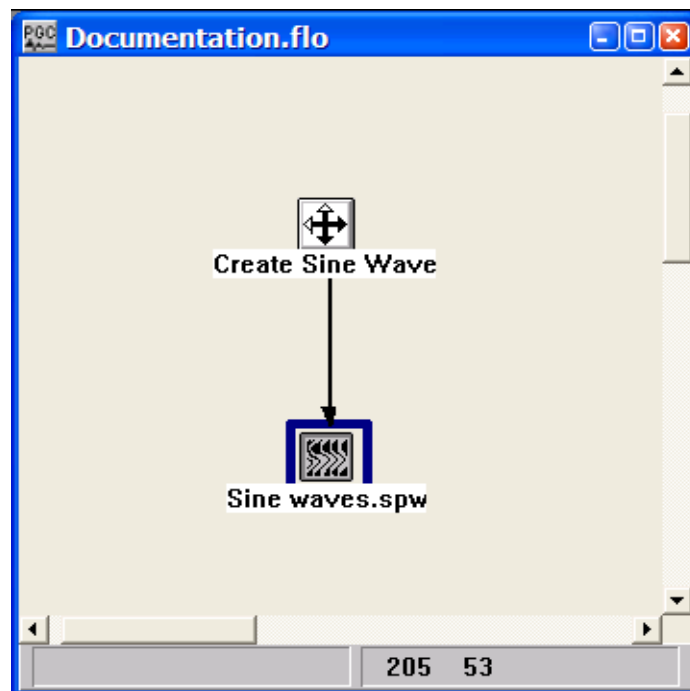
The Create Sine Waves step is a utility for testing purposes. It creates a series of mono frequency sine waves with each trace being a different frequency from the start frequency to the end.

Input Links:

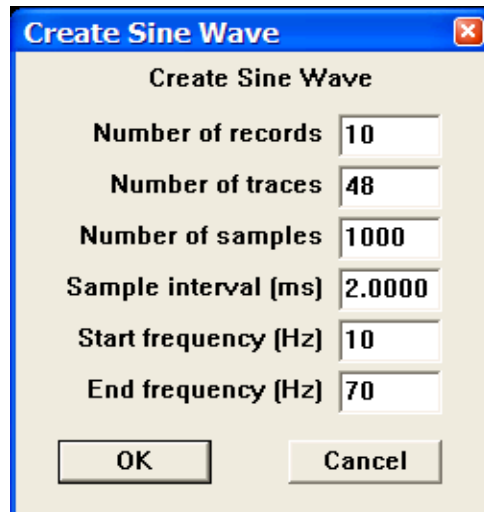
None.

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:

A screenshot of a Windows-style dialog box titled "Create Sine Wave". The dialog has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. It contains six labeled input fields, each with a text box to its right: "Number of records" with value "10", "Number of traces" with value "48", "Number of samples" with value "1000", "Sample interval (ms)" with value "2.0000", "Start frequency (Hz)" with value "10", and "End frequency (Hz)" with value "70". At the bottom, there are two buttons: "OK" on the left and "Cancel" on the right.

Create Sine Wave

Create Sine Wave

Number of records 10

Number of traces 48

Number of samples 1000

Sample interval (ms) 2.0000

Start frequency (Hz) 10

End frequency (Hz) 70

OK Cancel

Parameter Description:

Number of records — Enter the number of records to create.

Number of traces — Enter the number of traces per record.

Number of samples — Enter the number of samples per trace.

Sample interval (ms) — Enter the sample interval of the traces in milliseconds.

Start frequency (Hz) — Enter the frequency of the first trace in Hertz.

End frequency (Hz) — Enter the frequency of the last trace in Hertz.

Create Spikes

Usage:

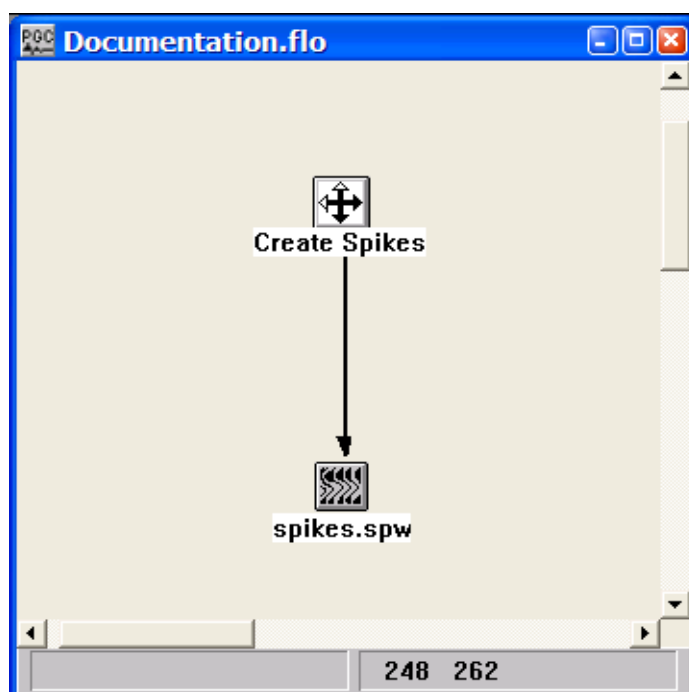
The Create Spikes step builds traces consisting of an impulse response series.

Input Links:

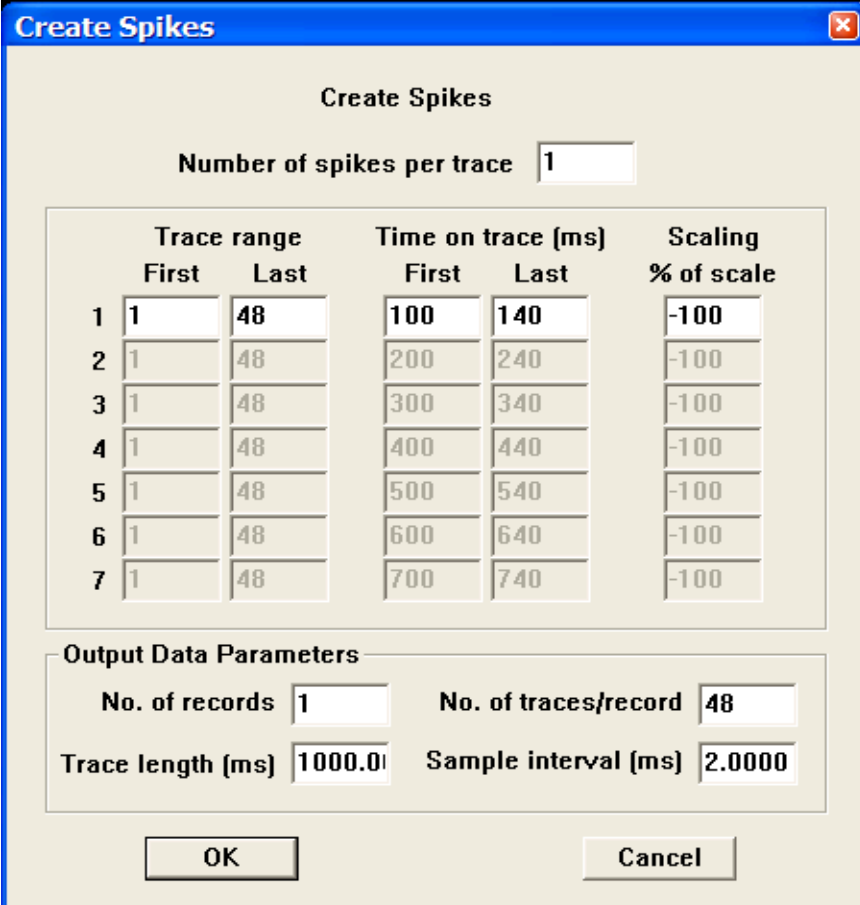
None.

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:



The 'Create Spikes' dialog box is titled 'Create Spikes' and features a close button in the top right corner. It contains a section for 'Number of spikes per trace' with a text box set to '1'. Below this is a table with 7 rows and 5 columns. The columns are labeled 'Trace range' (with sub-labels 'First' and 'Last'), 'Time on trace (ms)' (with sub-labels 'First' and 'Last'), and 'Scaling' (with sub-label ' % of scale'). The table contains the following values:

	Trace range		Time on trace (ms)		Scaling
	First	Last	First	Last	% of scale
1	1	48	100	140	-100
2	1	48	200	240	-100
3	1	48	300	340	-100
4	1	48	400	440	-100
5	1	48	500	540	-100
6	1	48	600	640	-100
7	1	48	700	740	-100

Below the table is a section titled 'Output Data Parameters' containing four text boxes: 'No. of records' (1), 'No. of traces/record' (48), 'Trace length (ms)' (1000.0), and 'Sample interval (ms)' (2.0000). At the bottom are 'OK' and 'Cancel' buttons.

Parameter Description:

Number of spikes per trace — Enter the number of impulses to create on each trace.

Trace Range - First — Enter the first trace in the record that will contain a spike.

Trace Range - Last — Enter the last trace in the record that will contain a spike.

Time on Trace (ms) - First — Enter the time of the spike on the first trace.

Time on Trace (ms) - Last — Enter the time of the spike on the last trace.

Scaling % of scale — Enter the scale as a percentage of the maximum value of the trace for this spike.

Output Data Parameters:

No. of records — Enter the number of records to create.

No. of traces/record — Enter the number of traces per record.

Trace length (ms) — Enter the trace length in milliseconds.

Sample interval (ms) — Enter the sample interval of the traces in milliseconds.

F-X Trace Interpolation

Usage:

The F-X Trace Interpolation step performs a 2-to-1 f-x domain interpolation of the input gather. Trace headers of the interpolated traces are equal to the average of their two neighbors. The Trace Flag header field of the interpolated traces will be equal to 28 on output.

Input Links:

- 1) Seismic data in any sort order (mandatory).

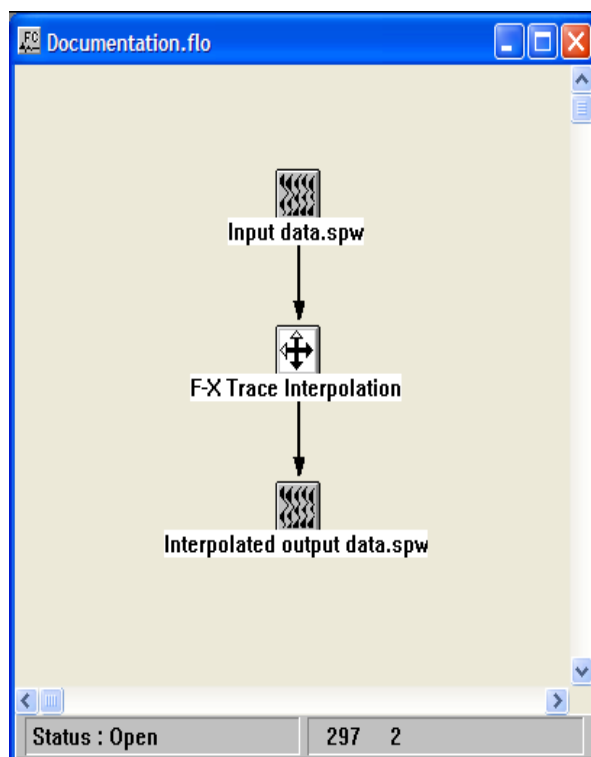
Output Links:

- 1) Seismic data with interpolated traces.

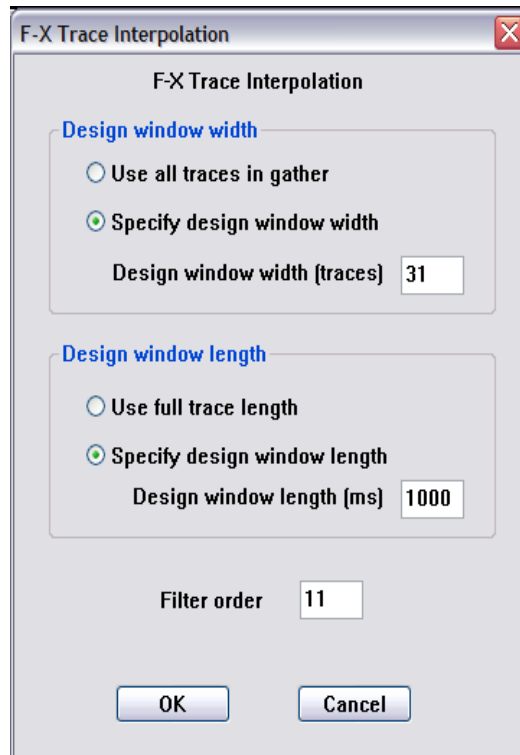
Reference:

Spitz, S., 1991 Seismic trace interpolation in the f-x domain, Geophysics, 56, p. 785.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "F-X Trace Interpolation". It contains two main sections: "Design window width" and "Design window length". In the "Design window width" section, the "Specify design window width" radio button is selected, and the "Design window width (traces)" text box contains the value "31". In the "Design window length" section, the "Specify design window length" radio button is selected, and the "Design window length (ms)" text box contains the value "1000". Below these sections is a "Filter order" text box containing the value "11". At the bottom of the dialog are "OK" and "Cancel" buttons.

Parameter Description:

Design widow width

Use all trace in gather — Allows the window width to vary with changes in fold for pre-stack trace interpolation.

Specify design window width – Use this option to enter a fixed design width

Design window width (traces) – Enter the width of the design window in units of traces

Design widow length

Use full trace length — Use this option if the design length is to equal the record length.

Specify design window length – Use this option to enter a fixed design length

Design window length (ms) – Enter the length of the design window in units of milliseconds

Filter order — Number of terms in the prediction filter.

I/O SEG Y File

Usage:

The I/O SEG Y File step is for the direct input of SEG Y data recorded with an I/O System IV recording instrument.

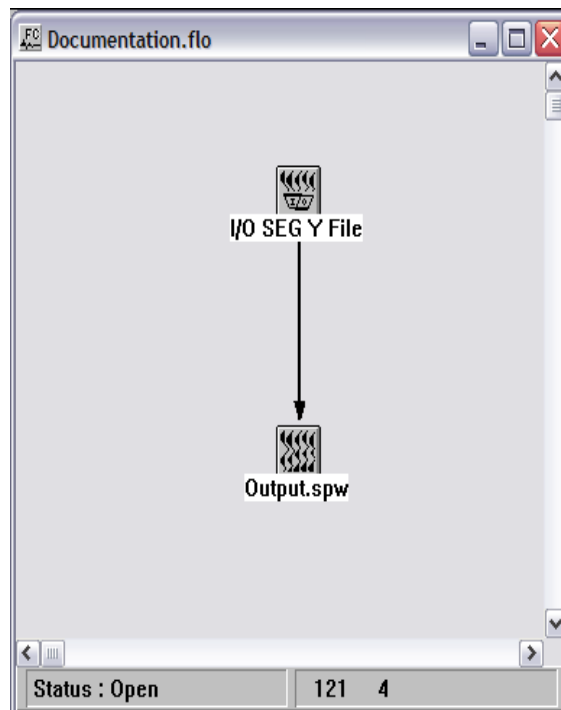
Input Links:

1) None. The I/O SEG Y file is selected inside the step dialog (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

I/O SEG Y File

I/O SEG Y File

☒ Specify input directory
☐ Specify starting input file

Input Directory...

Dataset Parameters

		Override
Number of records	0	<input type="checkbox"/>
Sample interval (ms)	0.0000	<input type="checkbox"/>
Samples per trace	0	<input type="checkbox"/>

Maximum traces per record 2048

☐ Input files as they are written to disk
☒ Strip auxiliary traces

OK Cancel

Parameter Description:

Specify input directory — With the radio button set to Specify input directory, the browse button toggles to Input Directory... Use the Input Directory button to specify the folder where the SEG Y files are located.

Specify starting input file — With the radio button set to Specify starting input file, the browse button toggles to First Input File... Use the First Input File button to specify the first SEG Y file, located inside the Input Directory, to be reformatted.

Number of records — By default, all records will be reformatted. Check the override box to specify the number of records, starting with the first input file.

Sample interval (ms) — By default the sample interval will be extracted from the binary header. If that value is absent or incorrect, check the override box and specify a sample interval in milliseconds.

Samples per trace — By default the number of samples per trace will be extracted from the binary header. If that value is absent or incorrect, check the override box and specify a the number of samples per trace

Interpolate Traces

Usage:

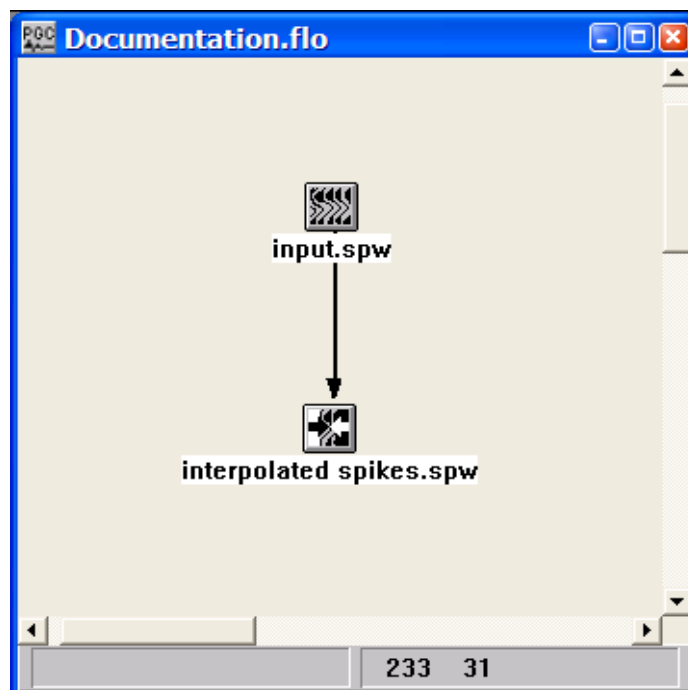
The Interpolate Traces step performs a 2-to-1 time domain interpolation of the input gather.

Input Links:

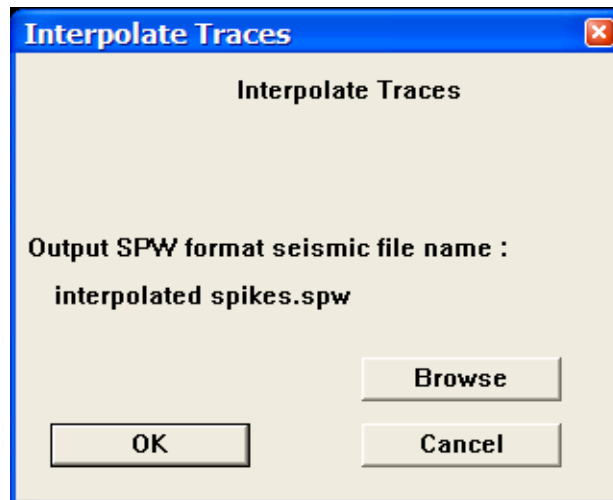
1) Seismic data in any sort order (mandatory).

Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:

Step Parameter Dialog:



Parameter Description:

Output SPW format seismic file name — Use the Browse button to specify the output file containing the interpolated seismic file.

Progress T2 SEGD File

Usage:

The Progress T2 SEGD File step is for the direct input of SEGD.

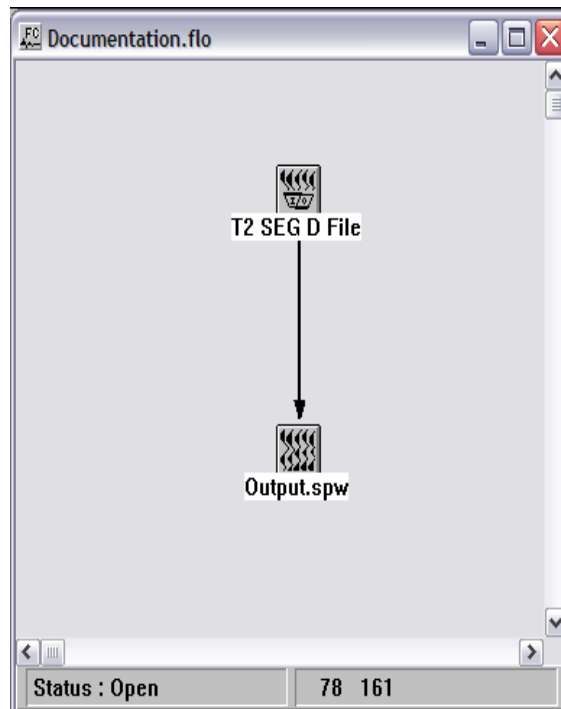
Input Links:

1) None. The SEGD file is selected inside the step dialog (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

T2 SEG D Input

T2 SEG D File

☒ Specify input directory
☐ Specify starting input file

Input Directory...

Dataset Parameters

		Override
Number of records	0	<input type="checkbox"/>
Sample interval (ms)	0.0000	<input type="checkbox"/>
Samples per trace	0	<input type="checkbox"/>

Maximum traces per record 2048

☐ Input files as they are written to disk
☒ Strip auxiliary traces

OK Cancel

Parameter Description:

Specify input directory — With the radio button set to Specify input directory, the browse button toggles to Input Directory... Use the Input Directory button to specify the folder where the SEG D files are located.

Specify starting input file — With the radio button set to Specify starting input file, the browse button toggles to First Input File... Use the First Input File button to specify the first SEG D file, located inside the Input Directory, to be reformatted.

Number of records — By default, all records will be reformatted. Check the override box to specify the number of records, starting with the first input file.

Sample interval (ms) — By default the sample interval will be extracted from the general header. If that value is absent or incorrect, check the override box and specify a sample interval in milliseconds.

Samples per trace — By default the number of samples per trace will be extracted from the general header. If that value is absent or incorrect, check the override box and specify the number of samples per trace.

Resample Seismic

Usage:

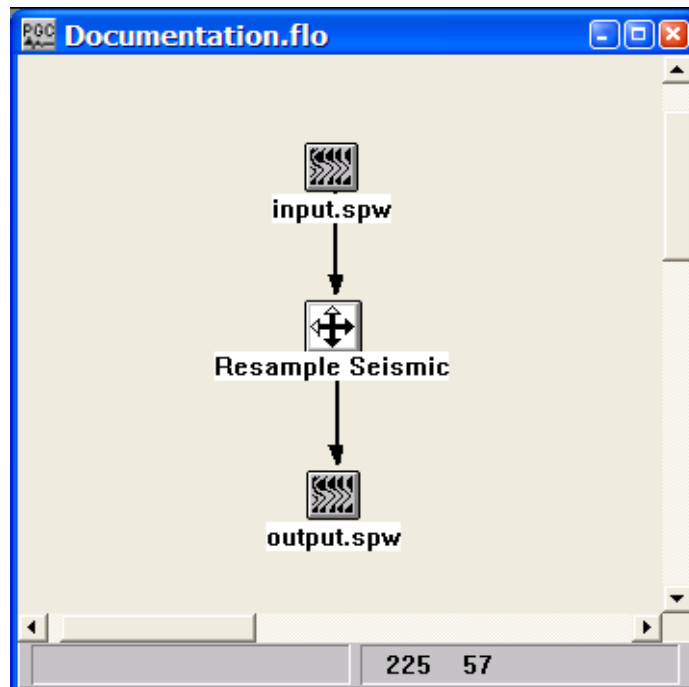
The Resample Seismic step creates a copy of a data set with options to (1) resample to a specified sample interval, and (2) change the start time and trace length of the data on the fly.

Input Links:

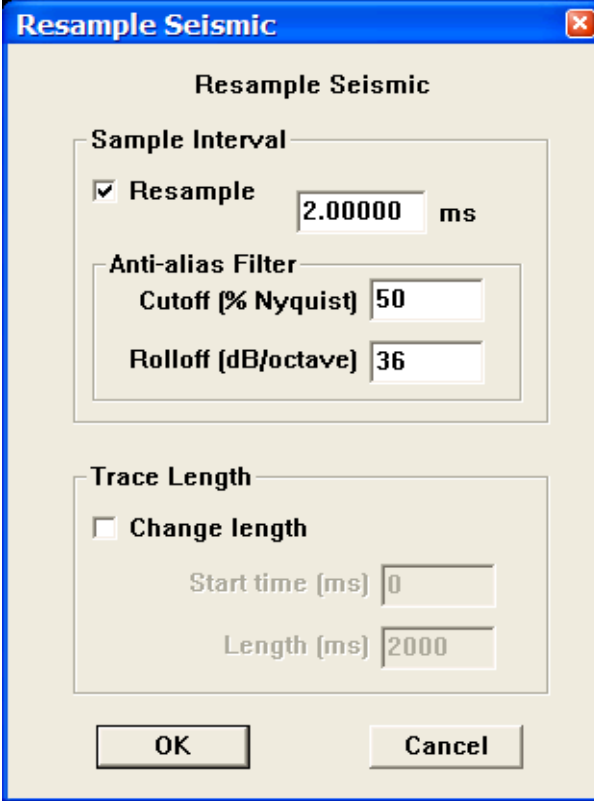
1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Resample Seismic". It has a blue title bar with a close button (X) in the top right corner. The dialog is divided into three main sections: "Sample Interval", "Anti-alias Filter", and "Trace Length".

- Sample Interval:** Contains a checked checkbox labeled "Resample" and a text input field with the value "2.00000" followed by the unit "ms".
- Anti-alias Filter:** Contains two text input fields: "Cutoff (% Nyquist)" with the value "50" and "Rolloff (dB/octave)" with the value "36".
- Trace Length:** Contains an unchecked checkbox labeled "Change length". Below it are two text input fields: "Start time (ms)" with the value "0" and "Length (ms)" with the value "2000".

At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Resample — If checked, the traces will be resampled to the specified sample interval.

Anti-alias Filter —

Cutoff (%Nyquist) — Enter the percentage of the Nyquist frequency at which an anti-alias filter is applied.

Rolloff (db/Octave) — Enter the rolloff of the filter in dB/Octave.

Change Length — If checked, the traces will be truncated or extended to the specified length.

Start time (ms) — Enter the start time of the trace to output in milliseconds.

Length (ms) — Enter the length of the trace to output in milliseconds

SEG 2 File

Usage:

The SEG2 File step allows for direct input of SEG-2 formatted data from a disk file.

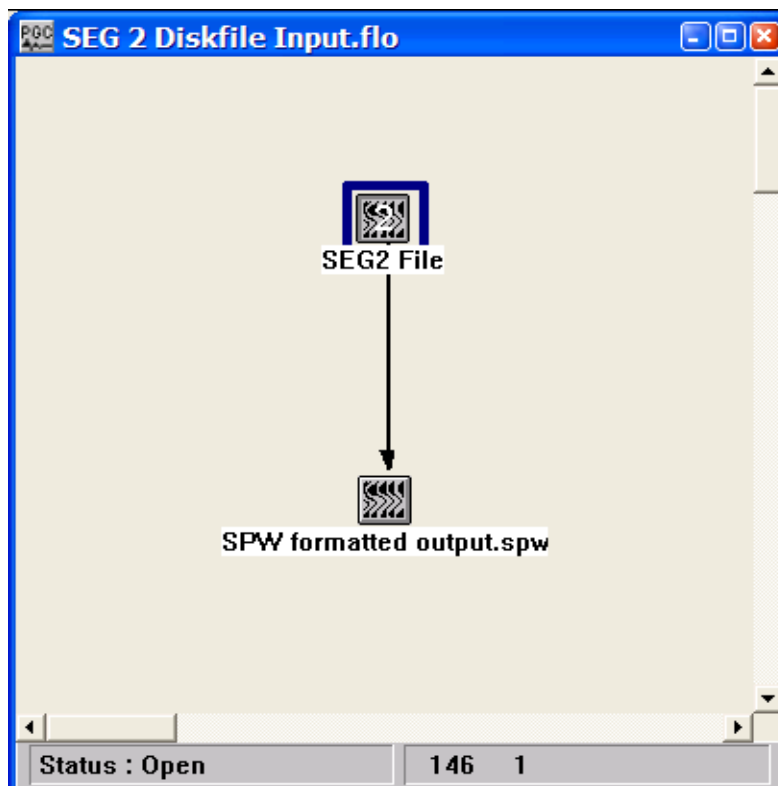
Input Links:

None. The SEG-2 disk file is selected in the SEG2 File dialog by means of a Browse button.

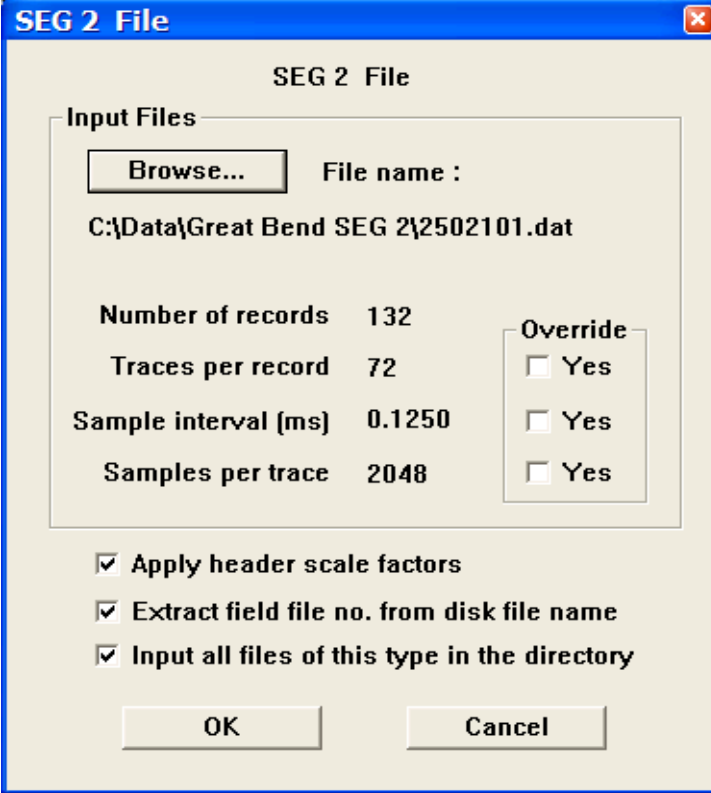
Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "SEG 2 File". Inside the dialog, there is a section labeled "Input Files" which contains a "Browse..." button and a text field for "File name :". The file name entered is "C:\Data\Great Bend SEG 2\2502101.dat". Below this, there are four rows of parameters: "Number of records" (132), "Traces per record" (72), "Sample interval (ms)" (0.1250), and "Samples per trace" (2048). To the right of these values is an "Override" section with three checkboxes, each labeled "Yes". Below the parameters, there are three checked checkboxes: "Apply header scale factors", "Extract field file no. from disk file name", and "Input all files of this type in the directory". At the bottom of the dialog are "OK" and "Cancel" buttons.

Parameter	Value	Override
Number of records	132	<input type="checkbox"/> Yes
Traces per record	72	<input type="checkbox"/> Yes
Sample interval (ms)	0.1250	<input type="checkbox"/> Yes
Samples per trace	2048	<input type="checkbox"/> Yes

☒ Apply header scale factors
☒ Extract field file no. from disk file name
☒ Input all files of this type in the directory

Parameter Description:

Input Files — Select the SEG-2 disk file and set the input parameters.

Browse – Click on the Browse button to select the SEG-2 disk file. Once the file has been selected, the values in the SEG-2 trace header indicating the number of records, the number of traces per record, the sample interval, and the number of samples per trace will be displayed in the SEG-2 File dialog. Be sure to confirm the verity of these values. If they are not as expected, an option exists to override these values so that the SEG-2 file may be successfully reformatted.

Number of records – Indicates the number of records in the SEG-2 disk file inferred from the SEG-2 file header.

Traces per record — Indicates the number of traces per record stored in bytes 6 and 7 of the SEG-2 file descriptor block.

Override – Click yes if the Traces per record value is not correct. Enter the correct value.

Sample interval (ms) — Indicates the sample interval stored in the appropriate sub-string of the SEG-2 file descriptor block.

Override – Click yes if the Sample interval value is not correct. Enter the correct value.

Samples per trace — Indicates the number of samples per trace stored in bytes 8-11 of the SEG-2 trace descriptor block.

Override – Click yes if the Samples per trace value is not correct. Enter the correct value.

Apply header scale factors — If checked, the scale factors written to the trace header will be applied to the output data file.

Extract field file number from disk file name – If checked, the field file number in the output data file will be extracted from the field file name. File extensions will be dropped.

Input all file of this type in the directory – If checked, all additional files of the type selected will be reformatted. Otherwise, only the file selected will be reformatted.

SEG Y File

Usage:

The SEG Y File step allows for direct input of SEG Y formatted data from a disk file.

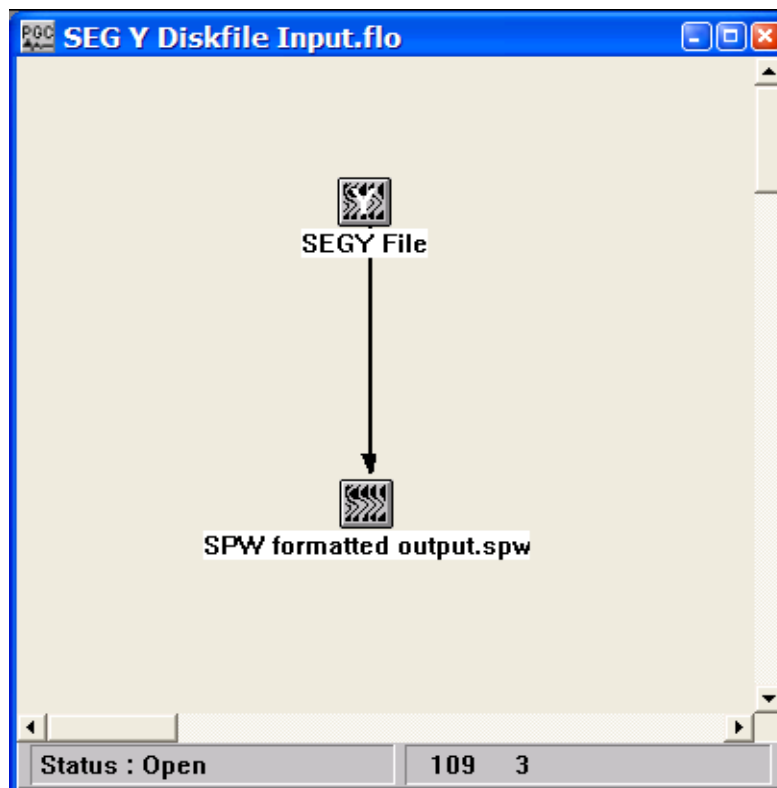
Input Links:

None. The SEG Y disk file is selected in the SEG Y File dialog by means of a Browse button.

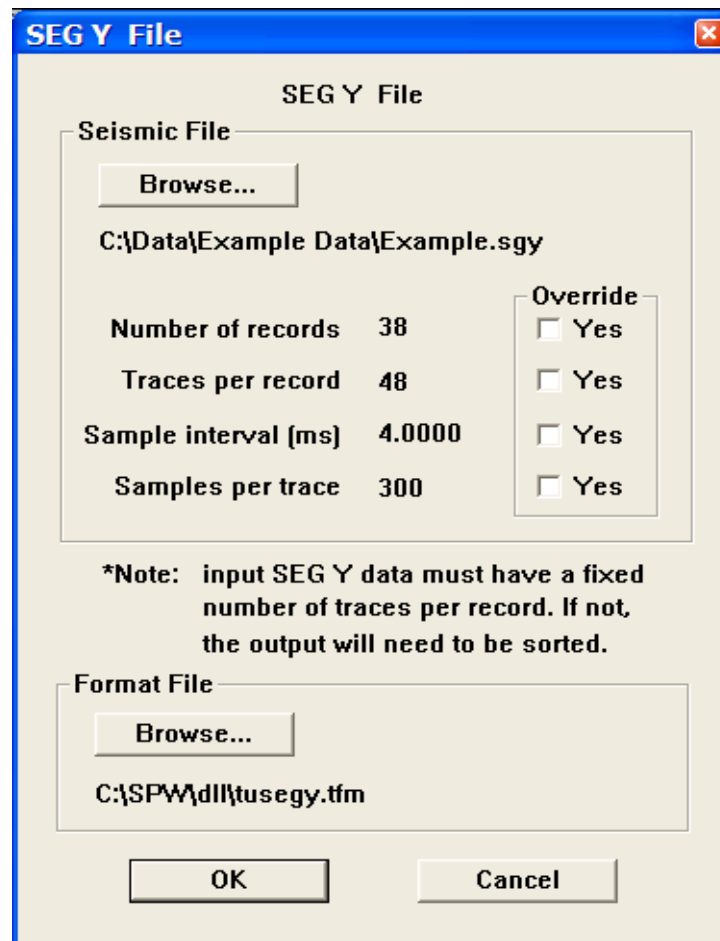
Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "SEG Y File". It has a blue title bar with a close button. The dialog is divided into two main sections: "Seismic File" and "Format File".

Seismic File section:

- A "Browse..." button is located at the top.
- Below the button, the file path "C:\Data\Example Data\Example.sgy" is displayed.
- A table of parameters is shown:

Parameter	Value	Override
Number of records	38	<input type="checkbox"/> Yes
Traces per record	48	<input type="checkbox"/> Yes
Sample interval (ms)	4.0000	<input type="checkbox"/> Yes
Samples per trace	300	<input type="checkbox"/> Yes

Format File section:

- A "Browse..." button is located at the top.
- Below the button, the file path "C:\SPW\dl\tusegy.tfm" is displayed.

At the bottom of the dialog are "OK" and "Cancel" buttons.

***Note:** input SEG Y data must have a fixed number of traces per record. If not, the output will need to be sorted.

Parameter Description:

Seismic File — Select the SEG Y disk file and set the input parameters.

Browse – Click on the Browse button to select the SEG Y disk file. Once the file has been selected, the values in the SEG-Y trace header indicating the number of records, the number of traces per record, the sample interval, and the number of samples per trace will be displayed in the SEG Y File dialog. Be sure to confirm the verity of these values. If they are not as expected, an option exists to override each of these values so that the SEG-Y file may be successfully reformatted.

Number of records – Indicates the number of records in the SEG-Y disk file inferred from the SEG-Y file header.

Override – Click yes if the Number of records value is not correct. Enter the correct value.

Traces per record — Indicates the number of traces per record stored in bytes 13-14 of the SEG-Y binary file header.

Override – Click yes if the Traces per record value is not correct. Enter the correct value.

Sample interval (ms) — Indicates the sample interval stored in bytes 17-18 of the SEG-Y binary file header.

Override – Click yes if the Sample interval value is not correct. Enter the correct value.

Samples per trace — Indicates the number of samples per trace stored in bytes 21-22 of the SEG-Y binary file header.

Override – Click yes if the Samples per trace value is not correct. Enter the correct value.

Format file — Select the file that accurately describes the SEG-Y file header. A default SEG Y format file is provided that describes the accepted SEG-Y standard as published by the Society of Exploration Geophysics. If the file or trace header of the selected SEG-Y file is known to differ from the SEG standard, an alternate file may be selected that describes the header.

Seismic File

Usage:

The Seismic File step allows you to select or create a SPW format seismic file on disk. It is the input SPW seismic format file and/or the output SPW seismic format file for almost all the processing steps.

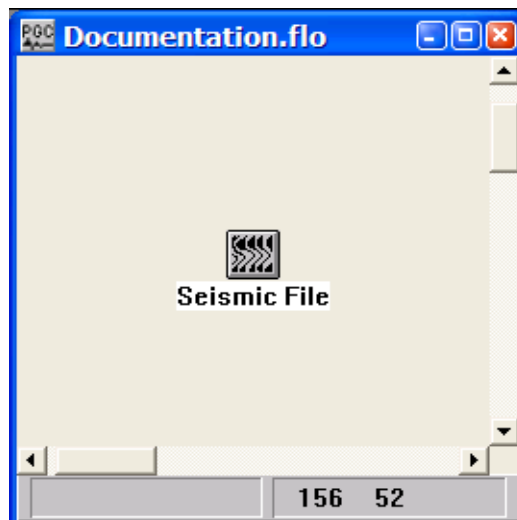
Input Links:

The Seismic File may receive input links from any processing step that requires an output seismic data file. In this case, execution of the flow will require that the user provides a file name for the Seismic File by left-clicking on the icon to open the Seismic File dialog and creating the output file name with the Browse button.

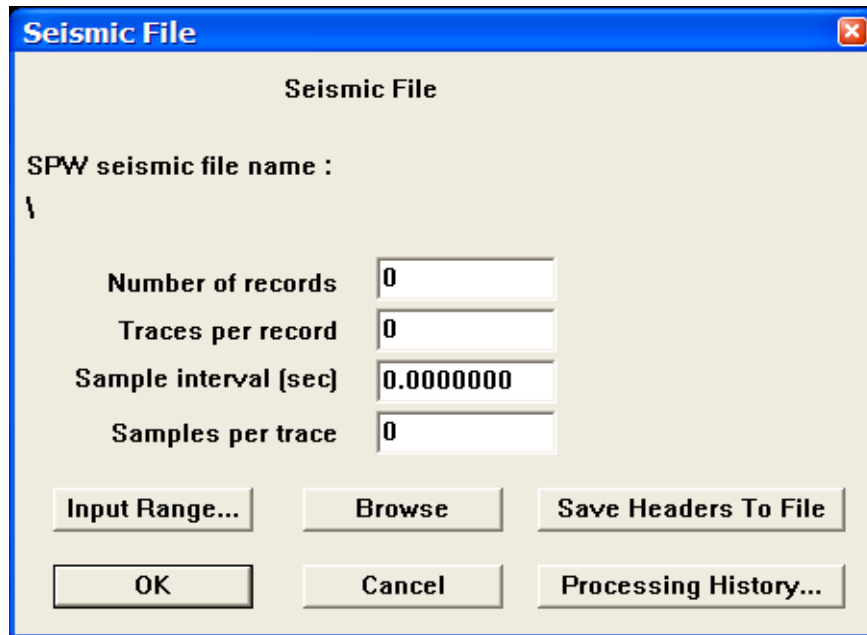
Output Links:

Output links from the Seismic File may be directed to any processing step that requires as input a seismic data file. In this case, execution of the flow will require that the user provides a file name for the Seismic File by left-clicking on the icon to open the Seismic File dialog and selecting the input file name with the Browse button.

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Seismic File". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. At the top, the title "Seismic File" is centered. Below it, the text "SPW seismic file name :" is followed by a text input field containing a backslash character "\". Below this, there are four rows of labels and text input fields: "Number of records" with "0", "Traces per record" with "0", "Sample interval (sec)" with "0.0000000", and "Samples per trace" with "0". At the bottom, there are six buttons arranged in two rows: "Input Range...", "Browse", and "Save Headers To File" in the top row; and "OK", "Cancel", and "Processing History..." in the bottom row.

Seismic File	
SPW seismic file name : \\	
Number of records	0
Traces per record	0
Sample interval (sec)	0.0000000
Samples per trace	0
Input Range... Browse Save Headers To File	
OK Cancel Processing History...	

Data description – If the seismic file is linked to an existing file name, the four parameter boxes provide a brief description of the data volume:

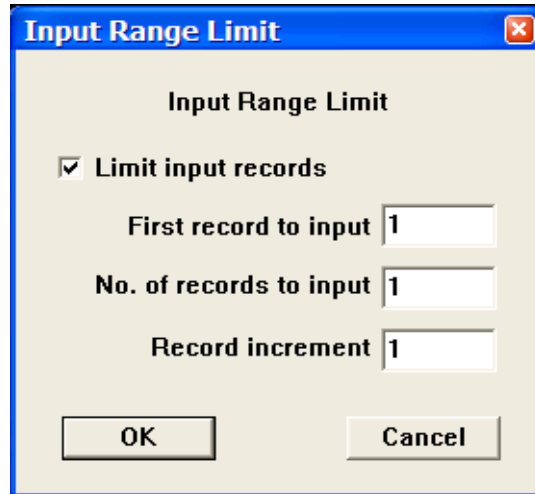
Number of records — The number of sort ordered records in the seismic file.

Traces per record — The number of traces per sort ordered record in the seismic file.

Sample interval – The time sample interval of the seismic file in seconds.

Samples per trace – The number of data samples per trace in the seismic file.

Input Range — Select this button to set an input range of records to process.

A screenshot of a dialog box titled "Input Range Limit". The dialog box has a blue title bar with a close button (X) in the top right corner. The main area is light beige. It contains a checked checkbox labeled "Limit input records". Below this are three input fields: "First record to input" with the value "1", "No. of records to input" with the value "1", and "Record increment" with the value "1". At the bottom are two buttons: "OK" and "Cancel".

Input Range Limit

☒ Limit input records

First record to input 1

No. of records to input 1

Record increment 1

OK Cancel

Limit input records — If checked, the input records will be limited to the specified records.

First record to input — Enter the first record to input into the processing flow.

No. of records to input — Enter the number of records to input into the processing flow.

Record increment — Enter the increment between records to input.

Browse — Select this button to set the seismic file name.

Save Headers to File — Select this button to export the seismic trace headers to an output text file. The output text file is a tab-delimited file that may be directly read into various text and spreadsheet applications.

Processing History — Select this button to display a history of all processing steps that have been performed on the data set from the first to the last process.

SPW Demo File

Usage:

The SPW Demo File is a seismic data file generated by the staff of the Parallel Geoscience Corporation that is designed to work with the SPW suite of software tools in Demo Mode. When operating in Demo Mode, the SPW suite of software tools does not require the use of a hardware key. As such, SPW Demo Files are meant to allow prospective users to evaluate the software without the need for a hardware key.

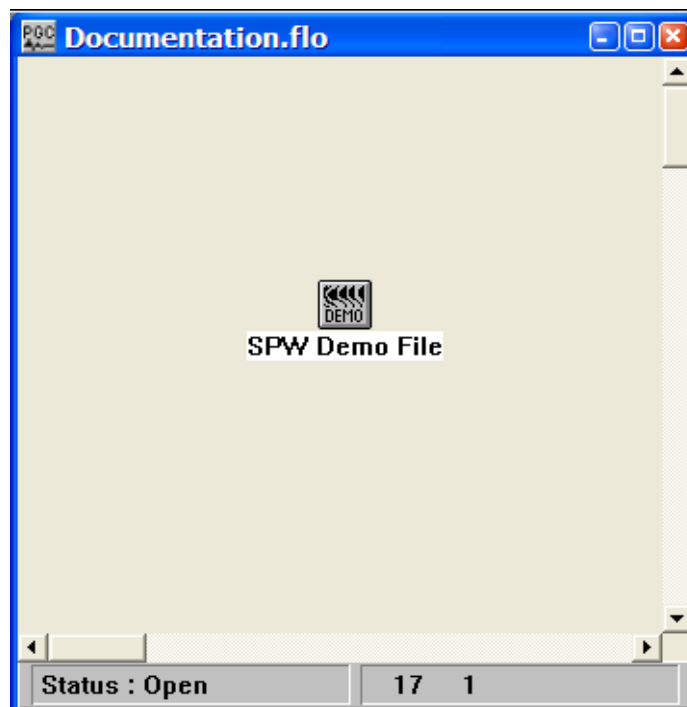
Input Links:

None. This file is created by the staff of the Parallel Geoscience Corporation.

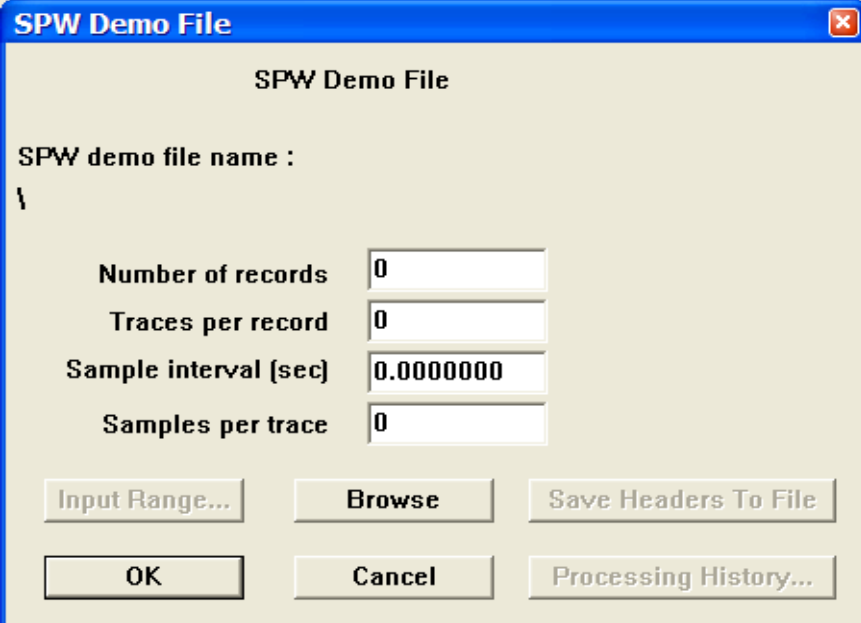
Output Links:

Output links from the Seismic File may be directed to any processing step that requires as input a seismic data file. In this case, execution of the flow will require that the user provides the file name of the SPW Demo File by left-clicking on the icon to open the Seismic File dialog and selecting the input file name with the Browse button.

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "SPW Demo File". It has a blue title bar with a close button in the top right corner. The main area is light beige. At the top, it says "SPW Demo File" again. Below that, it says "SPW demo file name :" followed by a text field containing a backslash character. Below this are four rows of labels and text boxes: "Number of records" with a box containing "0", "Traces per record" with a box containing "0", "Sample interval [sec]" with a box containing "0.0000000", and "Samples per trace" with a box containing "0". At the bottom, there are six buttons arranged in two rows: "Input Range...", "Browse", and "Save Headers To File" in the first row; and "OK", "Cancel", and "Processing History..." in the second row.

Parameter	Value
SPW demo file name	\
Number of records	0
Traces per record	0
Sample interval [sec]	0.0000000
Samples per trace	0

Buttons: Input Range..., Browse, Save Headers To File, OK, Cancel, Processing History...

Data description – If the seismic file is linked to an existing file name, the four parameter boxes provide a brief description of the data volume:

Number of records — The number of sort ordered records in the seismic file.

Traces per record — The number of traces per sort ordered record in the seismic file.

Sample interval – The time sample interval of the seismic file in seconds.

Samples per trace – The number of data samples per trace in the seismic file.

Browse — Select this button to set the seismic file name.

Seismic Merge

Usage:

The Seismic Merge step allows you to merge up to a total of five seismic files into a single output seismic file.

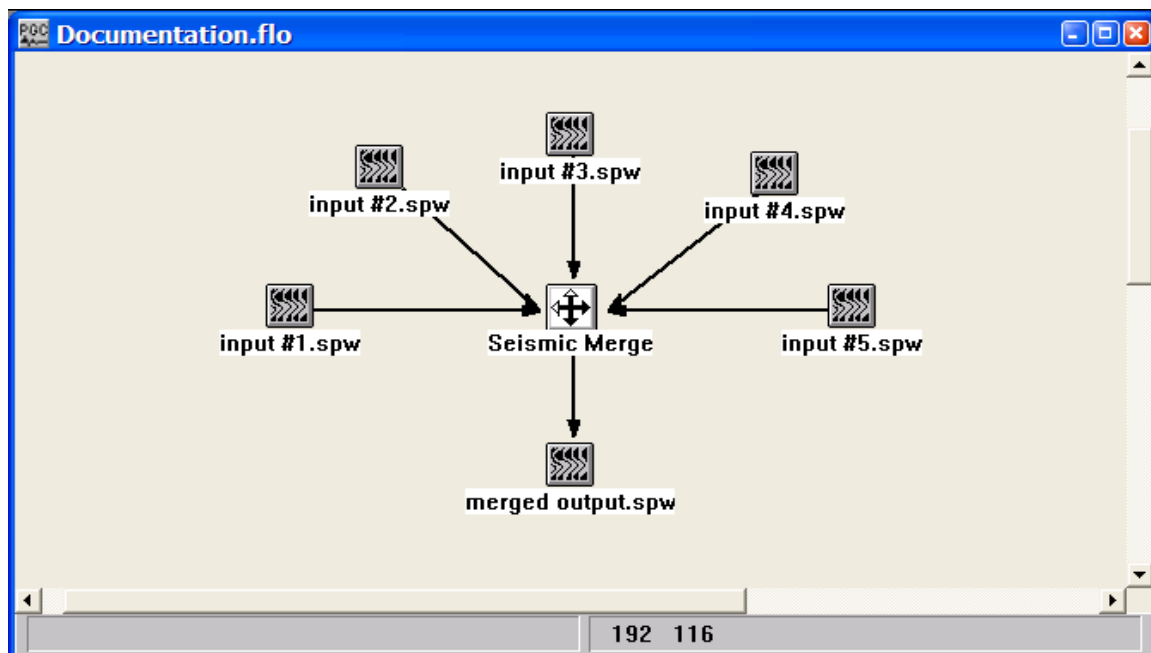
Input Links:

- 1) Seismic file in any sort order (mandatory).
- 2) Seismic file in any sort order (mandatory).
- 3) Seismic file in any sort order (optional).
- 4) Seismic file in any sort order (optional).
- 5) Seismic file in any sort order (optional).

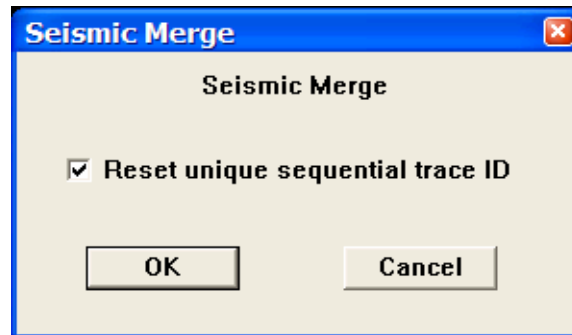
Output Links:

- 1) Seismic data unsorted (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Reset unique sequential trace ID — If checked, the SPW unique trace ID will be reset. This is highly recommended, as merged data files will often have overlapping trace ID numbers.

Sercel SEG D File

Usage:

The Sercel SEG D File step is for the direct input of SEG D data files recorded with a Sercel recording instrument.

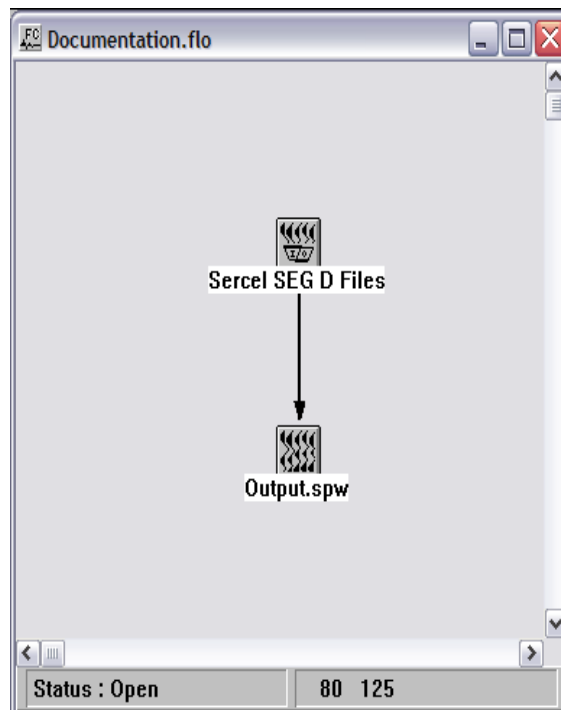
Input Links:

1) None. The SEG D file is selected inside the step dialog (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Sercel SEG D File

☒ Specify input directory
☐ Specify starting input file

Input Directory...

Dataset Parameters

		Override
Number of records	0	<input type="checkbox"/>
Sample interval (ms)	0.0000	<input type="checkbox"/>
Samples per trace	0	<input type="checkbox"/>

Maximum traces per record 2048

☐ Input files as they are written to disk
☒ Strip auxiliary traces

OK Cancel

Parameter Description:

Specify input directory — With the radio button set to Specify input directory, the browse button toggles to Input Directory... Use the Input Directory button to specify the folder where the SEG D files are located.

Specify starting input file — With the radio button set to Specify starting input file, the browse button toggles to First Input File... Use the First Input File button to specify the first SEG D file, located inside the Input Directory, to be reformatted.

Number of records — By default, all records will be reformatted. Check the override box to specify the number of records, starting with the first input file.

Sample interval (ms) — By default the sample interval will be extracted from the general header. If that value is absent or incorrect, check the override box and specify a sample interval in milliseconds.

Samples per trace — By default the number of samples per trace will be extracted from the general header. If that value is absent or incorrect, check the override box and specify the number of samples per trace.

Signature Input

Usage:

The Signature Input step allows for direct input of seismic signatures stored in ASCII format. The signature is converted to an SPW formatted seismic file.

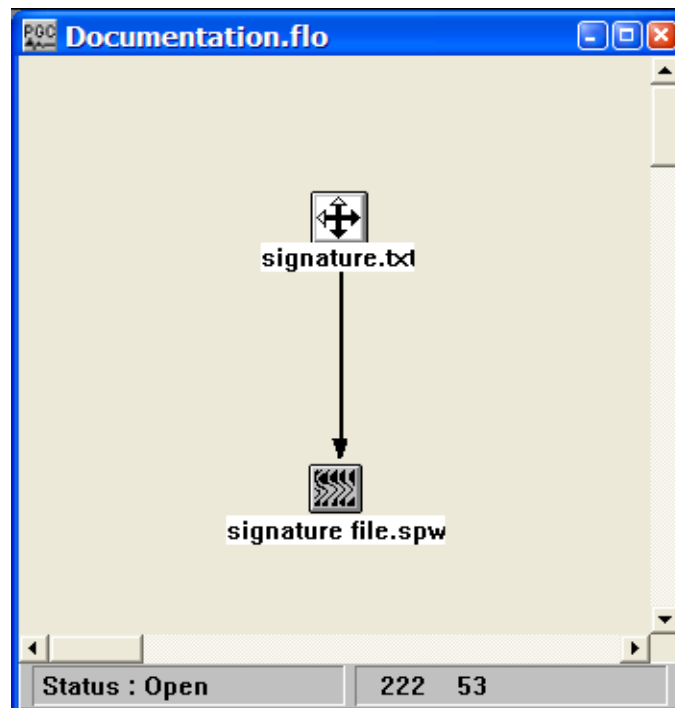
Input Links:

None. The signature file must be in a comma delimited format (e.g. -0.07451,) at the rate of one sample per row. This file is selected in the Signature Input dialog by means of a Browse button.

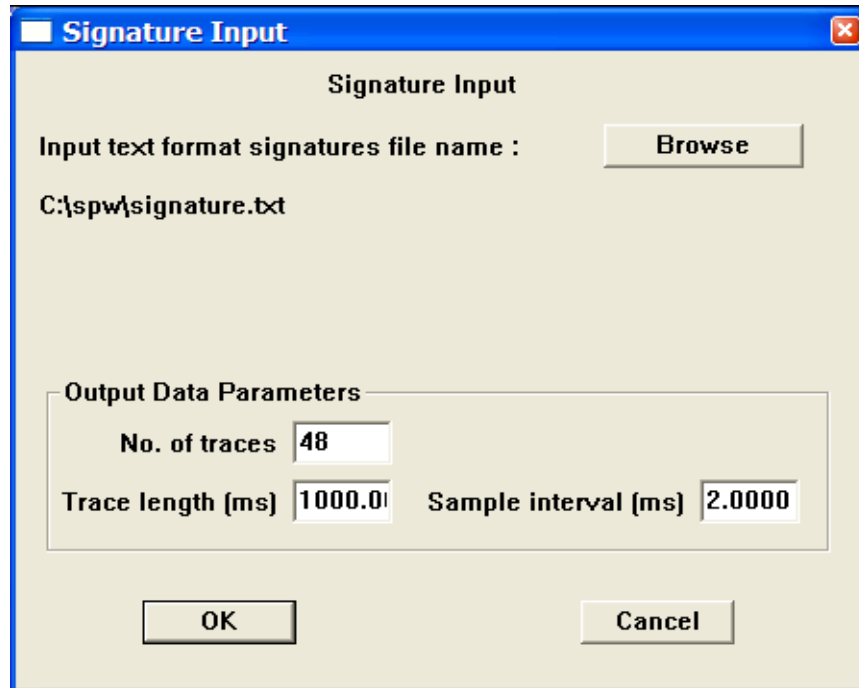
Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Signature Input". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. At the top, the title "Signature Input" is centered. Below it, there is a label "Input text format signatures file name :" followed by a text field containing "C:\spw\signature.txt" and a "Browse" button. Further down, there is a section titled "Output Data Parameters" enclosed in a thin border. Inside this section, there are three input fields: "No. of traces" with the value "48", "Trace length (ms)" with the value "1000.0", and "Sample interval (ms)" with the value "2.0000". At the bottom of the dialog, there are two buttons: "OK" and "Cancel".

Parameter Description:

Browse — Use the browse button to select the signature file.

Output Data Parameters

Number of traces — The number of times to duplicate the signature file.

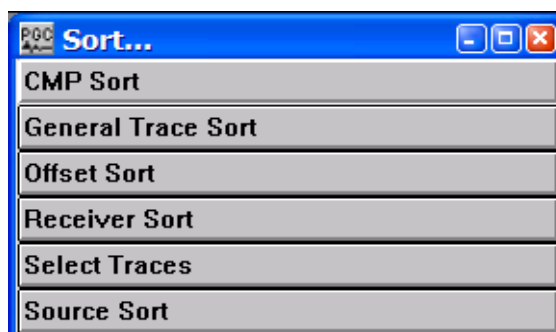
Trace length — The trace length of the signature file.

Sample interval (ms) – The time sample interval of the signature file.

Sorting Steps

This section documents the processing steps available in the Sorting Steps category. Each of the sort steps appears on the flow chart as a seismic icon. Therefore, compilation and execution of a seismic sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Processing steps currently available are:



CMP Sort

Usage:

The CMP Sort step allows you to sort a seismic file into CMP ordered records. The CMP Sort step appears on the flow chart as a seismic icon. Therefore, compilation and execution of the CMP Sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Input Links:

None – This process requires an input seismic disk file in any sort order.

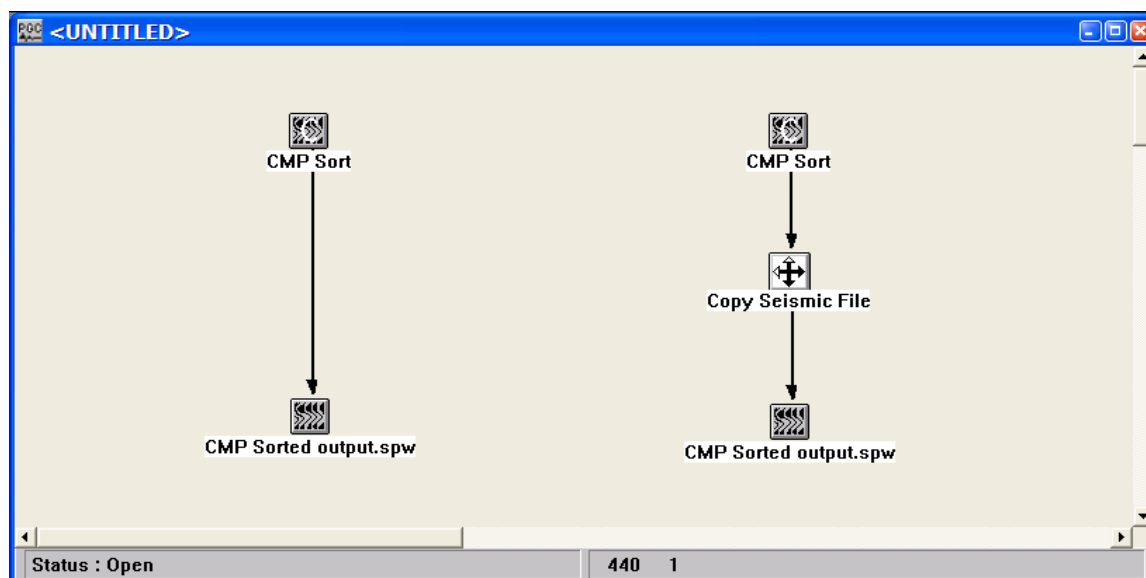
Output Links:

- 1) Seismic data in CMP sort order (mandatory).

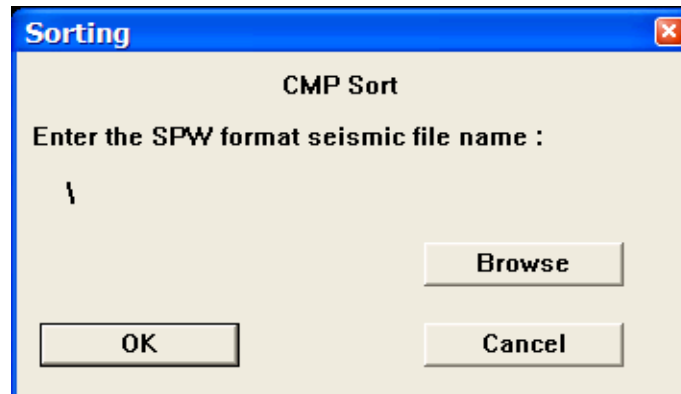
References:

See Technical Note TN-Sort.doc

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Browse — Select this button to set the input seismic file name.

General Trace Sort

Usage:

General Trace Sort allows you to sort your input seismic traces according to primary, secondary, and optional tertiary keys. The keys are trace header fields: Source location, receiver location, CMP location, stack record number (i.e. for data sets containing several stacked sections), offset, field file number, etc... You may select sub-ranges of any key, and choose to bin, or group together, several traces having adjacent sort keys, and omit traces between these bins.

The Primary Sort Key controls the sort type of the records you output. The Secondary Sort Key controls the sort type of the traces of these output records. These two sort keys are mandatory. The Tertiary Sort Key is optional and controls sorting of duplicate trace types such as two traces in a CMP bin at identical offsets.

For each sort key, you control the bin interval and bin size. A bin defines how the sorted data type is grouped. A bin consists of one or more adjacent locations sorted into the same output location. You must specify the size of the bin and the interval between bins. A bin size can be as small as one and as large as the number of locations in your data set. The bin interval is the number of locations to skip to reach the next location for output. The range limits allow you to limit the location in the output to the specific range of location you require for further analysis and processing.

The General Trace Sort step appears on the flow chart as a seismic icon. Therefore, compilation and execution of the General Trace Sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Input Links:

None – This process requires an input seismic disk file in any sort order.

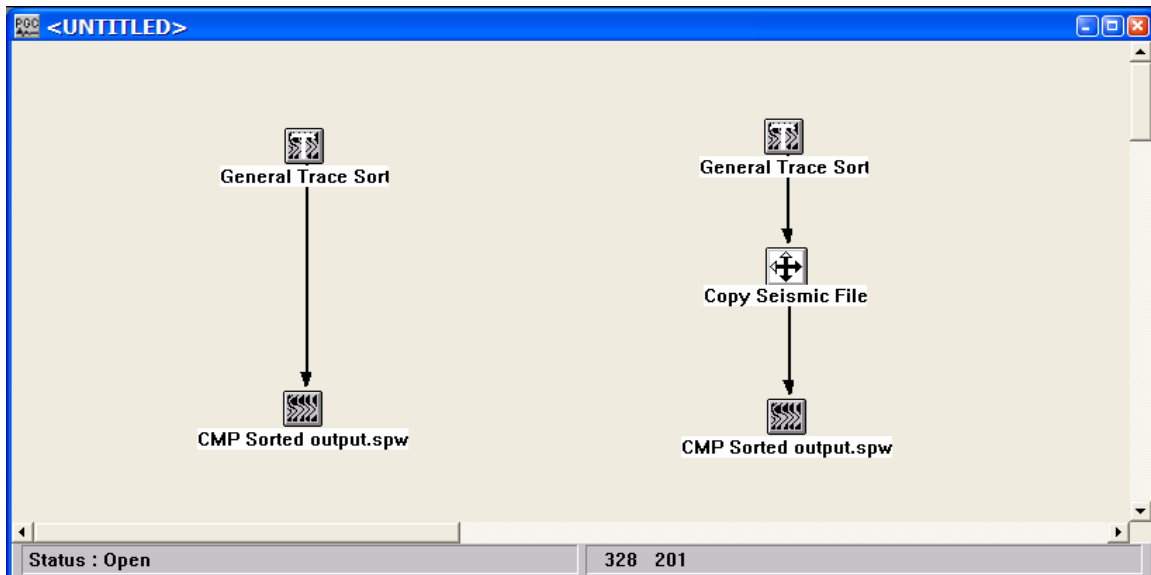
Output Links:

- 1) Seismic data in the selected sort order (mandatory).

References:

See Technical Note TN-Sort.doc

Example Flowchart:



Step Parameter Dialog:

General Trace Sort

General Trace Sort

Sorting Parameters		Output Range		Bin size	Bin interval
	Sort Key	Limit	Min	Max	
1	None	<input type="checkbox"/>	0.0	0.0	1
2	None	<input type="checkbox"/>	0.0	0.0	1
3	None	<input type="checkbox"/>	0.0	0.0	1
4	None	<input type="checkbox"/>	0.0	0.0	1
5	None	<input type="checkbox"/>	0.0	0.0	1

Input SPW format seismic file name :

\

Parameter Description:

Sort Key — Specify the sort key. (i.e. Source, Receiver, CMP Record No., Field File No., Offset etc...)

Output Range limit — If checked, this will set a range limit for the sort key.

Min — Enter the minimum value in the range limit of the sort key.

Max — Enter the minimum value in the range limit of the sort key.

Bin size — Specify a grouping of locations with adjacent sort keys.

Bin interval — Specify the increment between adjacent bins.

Browse — Select this button to set the input seismic file name.

General Sort Examples:

Example # 1 : If you want to sort for output of every third shot record in your data set, you would define the General Trace Sort parameters as follows:

Primary Sort Type: Source
Bin Size: 1
Bin Interval: 3

Secondary Sort Type: Offset
Bin Size: 1
Bin Interval: 1

Your output data set would consist of every third shot record with the traces in each record sorted by increasing offset distance.

Example # 2 : If you want to sort for output of every tenth CMP record in your data set with three adjacent CMP's in each bin (i.e. a CMP super gather for velocity semblance analysis), you would define the General Trace Sort parameters as follows:

Primary Sort Type: CMP
Bin Size: 3
Bin Interval: 10

Secondary Sort Type: Offset
Bin Size: 1
Bin Interval: 1

Your output data set would consist of every tenth CMP record with the traces in each record sorted by increasing offset distance. You could use the Range limits to select a specific range of CMP's and offsets to include in the output data set.

Example # 3 : If you want to sort for output of every shot record in your data set with only every third trace output, you would define the General Trace Sort parameters as follows:

Primary Sort Type: Source
Bin Size: 1
Bin Interval: 1

Secondary Sort Type: Offset
Bin Size: 1
Bin Interval: 3

Your output data set would consist of every shot record with only one-third the input traces present in each output record sorted by increasing offset distance.

Offset Sort

Usage:

The Offset Sort step allows you to sort a seismic file into offset ordered records. The Offset Sort step appears on the flow chart as a seismic icon. Therefore, compilation and execution of the Offset Sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Input Links:

None – This process requires an input seismic disk file.

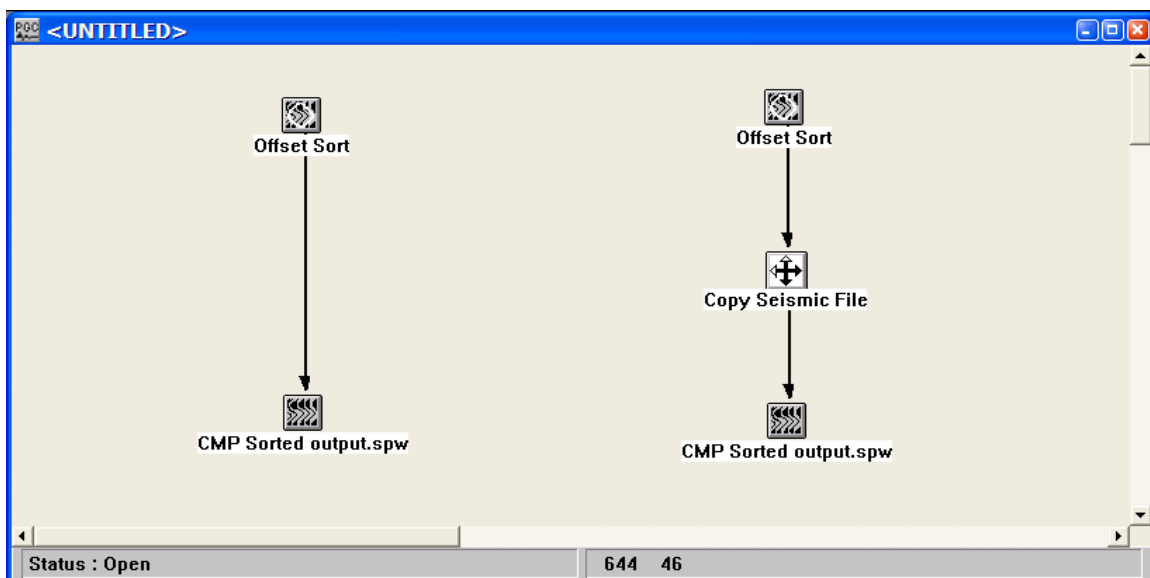
Output Links:

- 1) Seismic data in offset sort order (mandatory).

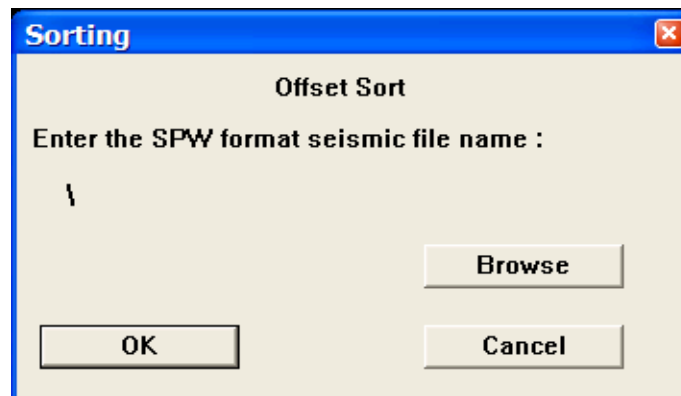
References:

See Technical Note TN-Sort.doc

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Browse — Select this button to set the input seismic file name.

Receiver Sort

Usage:

The Receiver Sort step allows you to sort a seismic file into receiver ordered records. The Receiver Sort step appears on the flow chart as a seismic icon. Therefore, compilation and execution of the Receiver Sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Input Links:

None – This process requires an input seismic disk file.

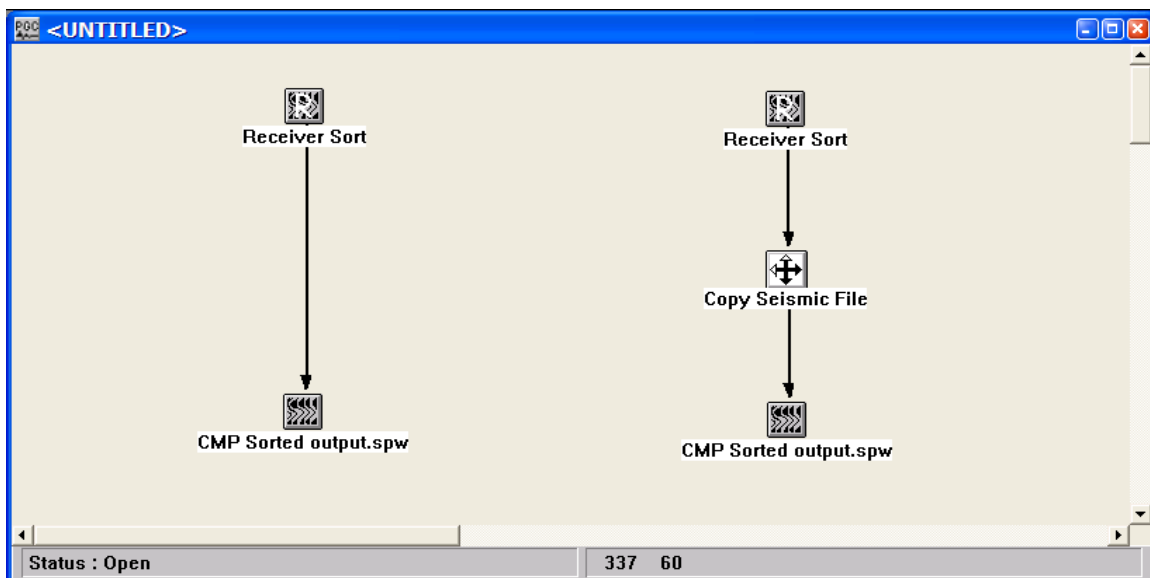
Output Links:

- 1) Seismic data in receiver sort order (mandatory).

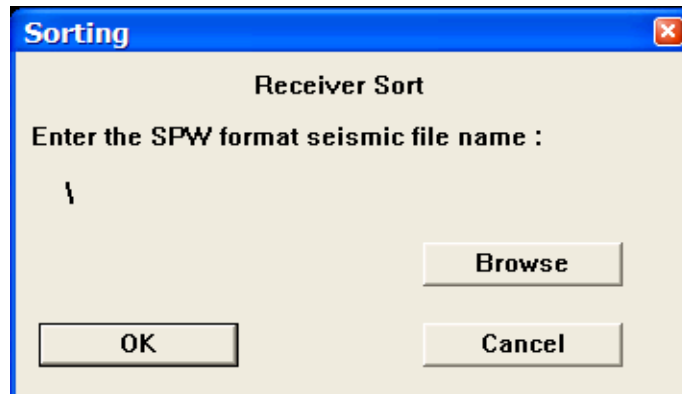
References:

See Technical Note TN-Sort.doc

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Browse — Select this button to set the input seismic file name.

Select Traces

Usage:

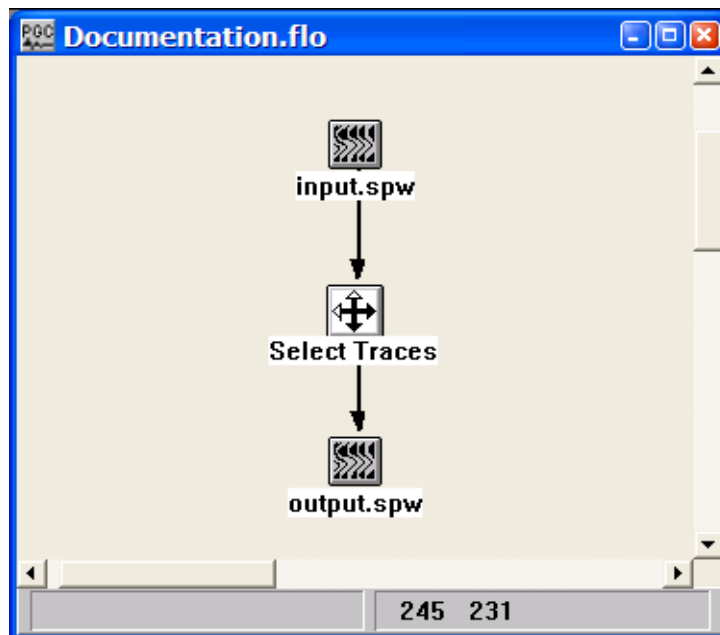
The Select Traces step allows you to select seismic data on the basis one or two header words.

Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:

Step Parameter Dialog:

The 'Select Traces' dialog box contains the following elements:

- Title Bar:** Select Traces (with a close button)
- First Range Key Section:**
 - First Range Key: None (dropdown)
 - Start: 1.00 (text box)
 - End: 1.00 (text box)
- Second Range Key Section:**
 - Second Range Key: None (dropdown)
 - Start: 1.00 (text box)
 - End: 1.00 (text box)
- Use range limit:** ☒ (checkbox)
- Buttons:** OK, Cancel

Parameter Description:

Use range limit – If checked, allows selection of minimum and maximum values of the range keys.

First Range Key — Specify the sort key. (i.e. Source, Receiver, CMP Record No., Field File No., Offset etc...).

Start – Enter the first value in the range limit of the first sort key.

End – Enter the last value in the range limit of the first sort key.

Second Range Key — Specify the sort key. (i.e. Source, Receiver, CMP Record No., Field File No., Offset etc...)

Start – Enter the first value in the range limit of the second sort key.

End – Enter the last value in the range limit of the second sort key.

Source Sort

Usage:

The Source Sort step allows you to sort a seismic file into source ordered records. The Source Sort step appears on the flow chart as a seismic icon. Therefore, compilation and execution of the Source Sort is performed by either of two methods. First, if the flow segment to be compiled only contains the sort step and the corresponding seismic output, the flow must be compiled and executed as a separate job. This is because the lack of an intermediate-processing step between the sort and the output will result in the compilation of all linked steps on the Flowchart canvas. Second, if the flow to be compiled contains an intermediate processing step (i.e. Copy Seismic Data) between the sort and the seismic output, the flow may be compiled and executed as the subset of a larger job flow on the Flowchart canvas.

Input Links:

None – This process requires an input seismic disk file.

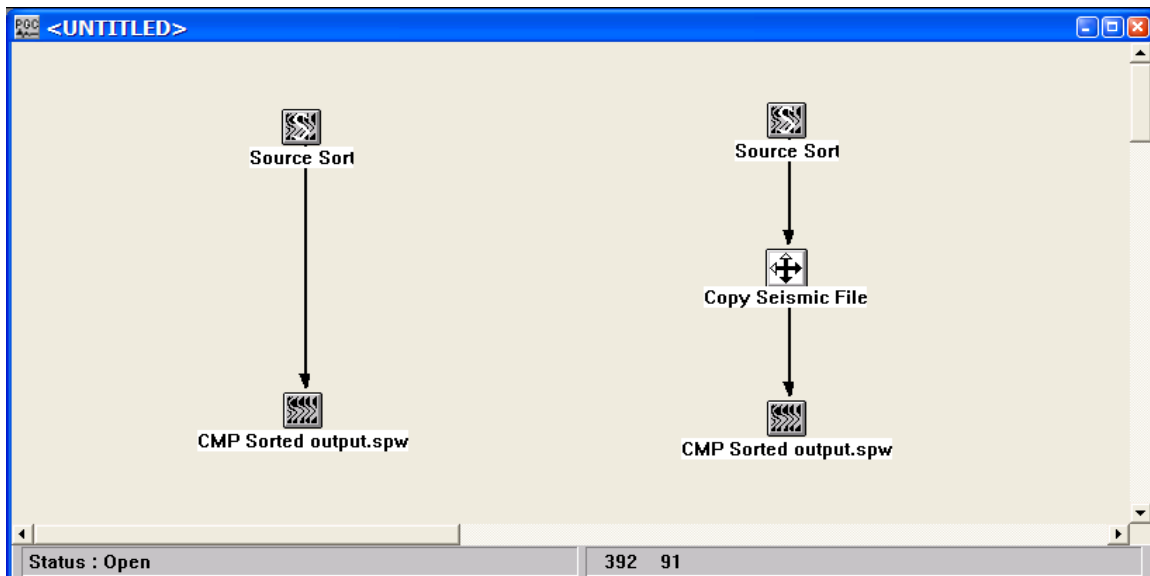
Output Links:

- 1) Seismic data in receiver sort order (mandatory).

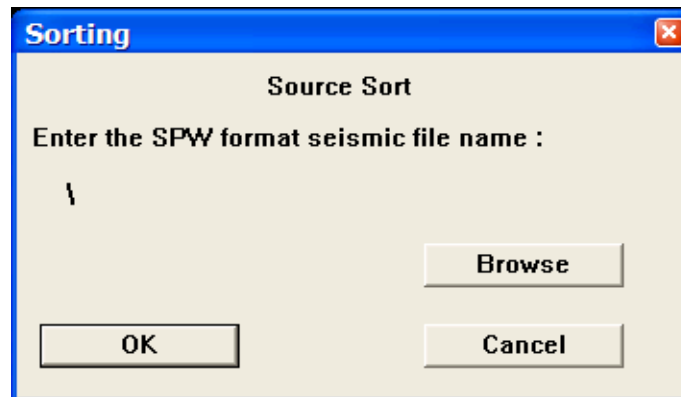
References:

See Technical Note TN-Sort.doc

Example Flowchart:



Step Parameter Dialog:



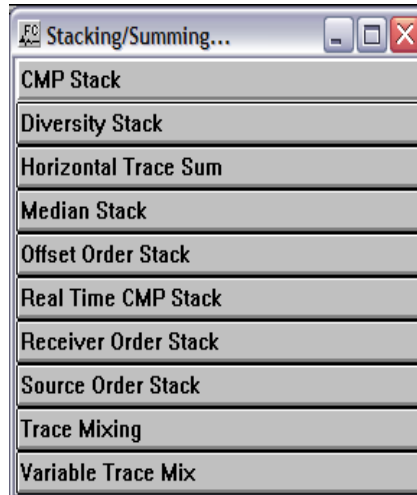
Parameter Description:

Browse — Select this button to set the input seismic file name.

Stacking and Summing Steps

This section documents the processing steps available in the Stacking and Summing Steps category.

Processing steps currently available are:



CMP Stack

Usage:

The CMP Stack step generates a CMP stack seismic file from CMP sorted input data. You may choose among stacking all offsets, the near 1/3 offsets, or the mid 1/3 offsets, the far 1/3 offsets. You may also choose to stack signed (positive and negative) or unsigned (absolute value of positive and negative) offsets. For the signed or unsigned offset cases you specify the minimum and maximum offsets to stack. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. fold ** EXP). You also specify whether you want to sum relative or absolute amplitude traces.

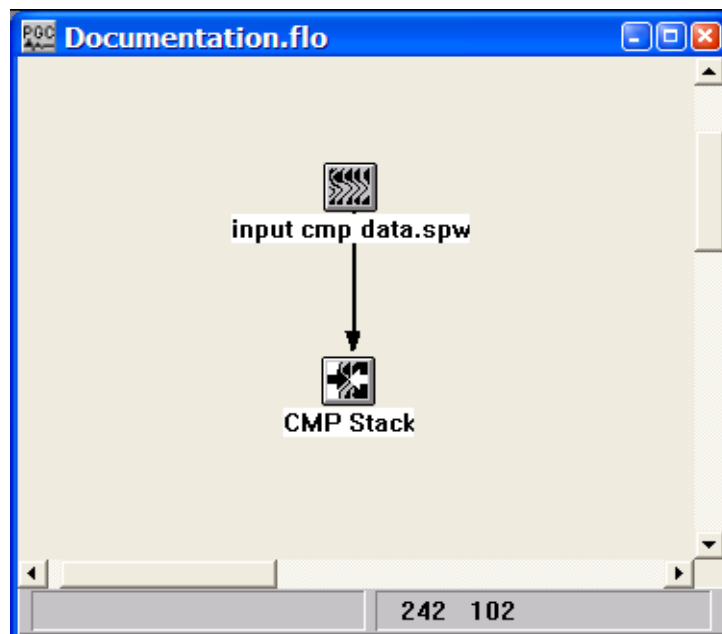
Input Links:

1) Seismic data in any CMP order (mandatory).

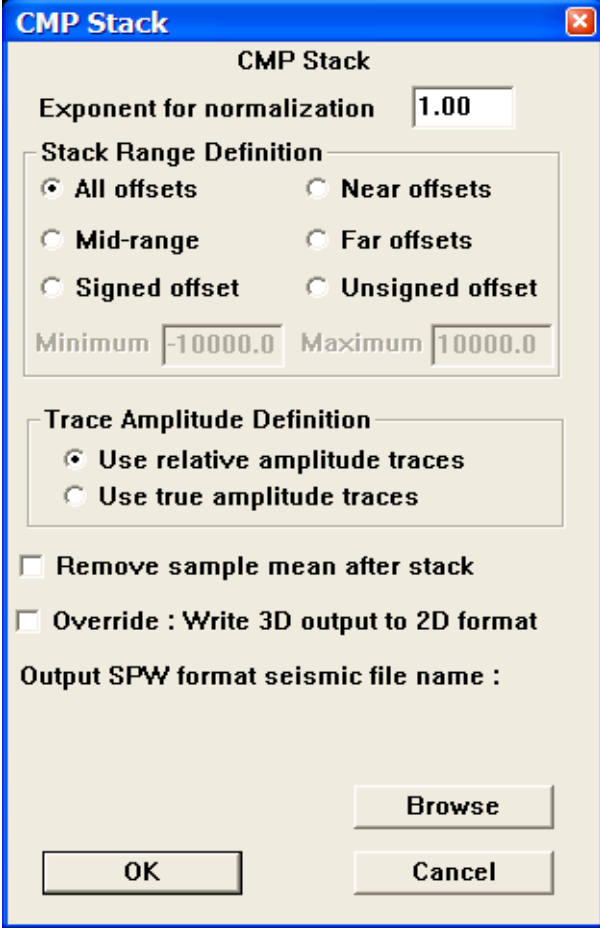
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "CMP Stack". It contains several settings for seismic data processing. At the top, there's a label "CMP Stack" and a close button. Below it, "Exponent for normalization" is set to "1.00". The "Stack Range Definition" section has five radio button options: "All offsets" (selected), "Near offsets", "Mid-range", "Far offsets", and "Signed offset". Below these are input fields for "Minimum" (-10000.0) and "Maximum" (10000.0). The "Trace Amplitude Definition" section has two radio button options: "Use relative amplitude traces" (selected) and "Use true amplitude traces". There are two checkboxes: "Remove sample mean after stack" and "Override : Write 3D output to 2D format", both currently unchecked. At the bottom, there's a label "Output SPW format seismic file name :" followed by a "Browse" button. At the very bottom are "OK" and "Cancel" buttons.

Parameter Description:

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Stack Range Definition — Set the offset range to stack.

All offsets — All offsets will be stacked.

Near offsets — The near 1/3rd offsets will be stacked.

Mid-range — The mid 1/3rd offsets will be stacked.

Far offsets — The far 1/3rd offsets will be stacked.

Signed offset — Offsets in the signed (both positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Unsigned offset — Offsets in the unsigned (absolute value of positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Minimum — Set the minimum offset range to stack.

Maximum — Set the maximum offset range to stack.

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Remove sample mean after stack – If checked, removes the average DC bias from each stacked trace.

Override: Write 3D output to 2D format –

Browse — Select this button to set the output seismic file name.

Diversity Stack

Usage:

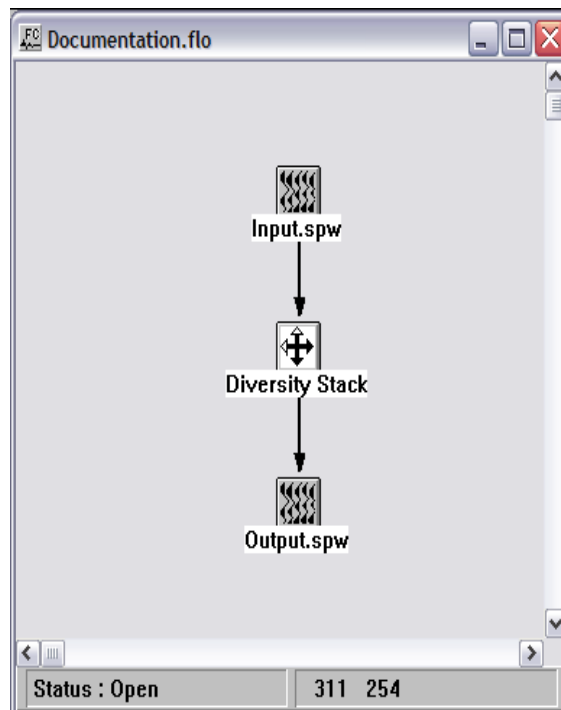
The Diversity Stack step performs a sample by sample horizontal stack using a specified percent of the samples centered on the median sample.

Input Links:

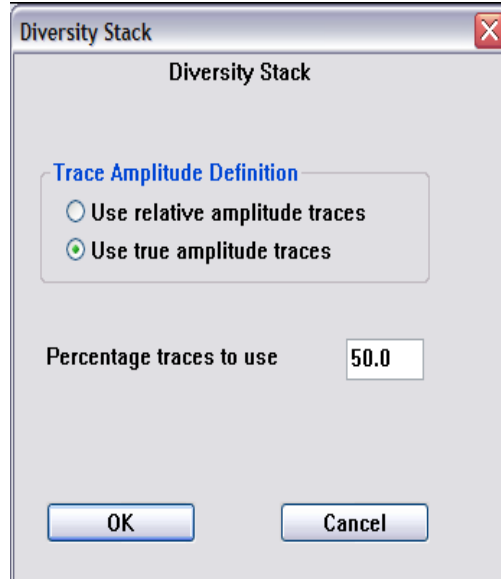
1) Seismic data in any sort order (mandatory).

Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:

Step Parameter Dialog:



Parameter Description:

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Percent of traces to use — Enter the percentage of traces to sum into each resulting output diversity stacked trace. A number such as 50 indicates that 50 % of the samples centered on the median sample value will be used in the diversity summed sample.

Horizontal Trace Sum

Usage:

The Horizontal Trace Sum step is used to perform a horizontal sum of multiple input traces into a single output trace on the basis of either the sequential or the offset order of the input traces.

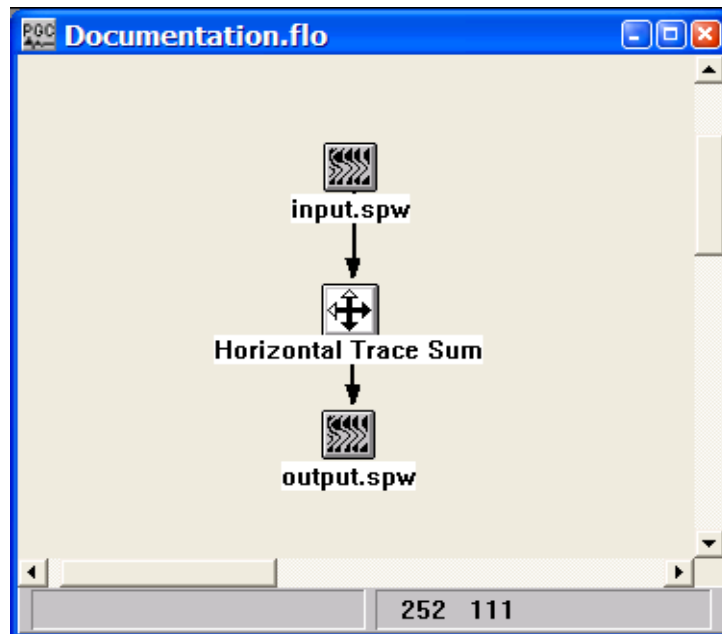
Input Links:

1) Seismic data in any sort order (mandatory).

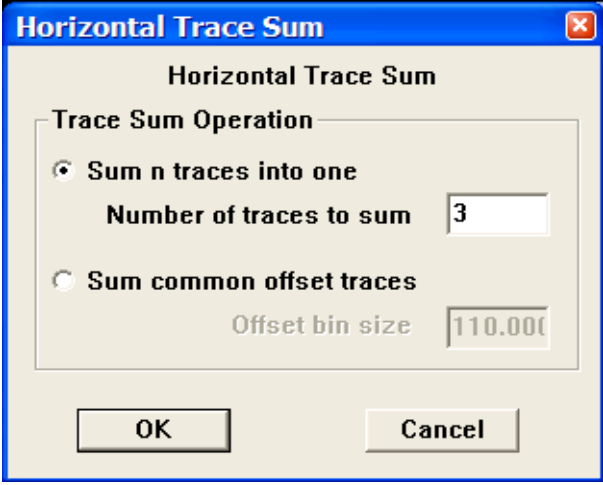
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Horizontal Trace Sum". It has a blue title bar with a close button (X) in the top right corner. The main area is light gray and contains the following elements:

- A section header "Horizontal Trace Sum" in bold black text.
- A label "Trace Sum Operation" in bold black text.
- Two radio button options:
 - The first option is "Sum n traces into one", which is selected (indicated by a filled radio button). Below it is a text label "Number of traces to sum" followed by a text input field containing the value "3".
 - The second option is "Sum common offset traces", which is not selected (indicated by an empty radio button). Below it is a text label "Offset bin size" followed by a text input field containing the value "110.000".
- At the bottom, there are two buttons: "OK" and "Cancel".

Parameter Description:

Trace Sum Operation – Select whether to sum traces sequentially or by common offset bin.

Sum n traces into one – Enter the number of sequential input traces to sum into a single output trace.

Sum common offset traces – Enter the offset bin size over which input traces will be summed into a single output trace. All input trace offsets falling between $(n) * \text{offset bin size}$ and $(n+1) * \text{offset bin size}$ will be summed into a single output trace.

Median Stack

Usage:

The Median Stack step performs a sample by sample horizontal stack using a specified percent of the samples centered on the median sample.

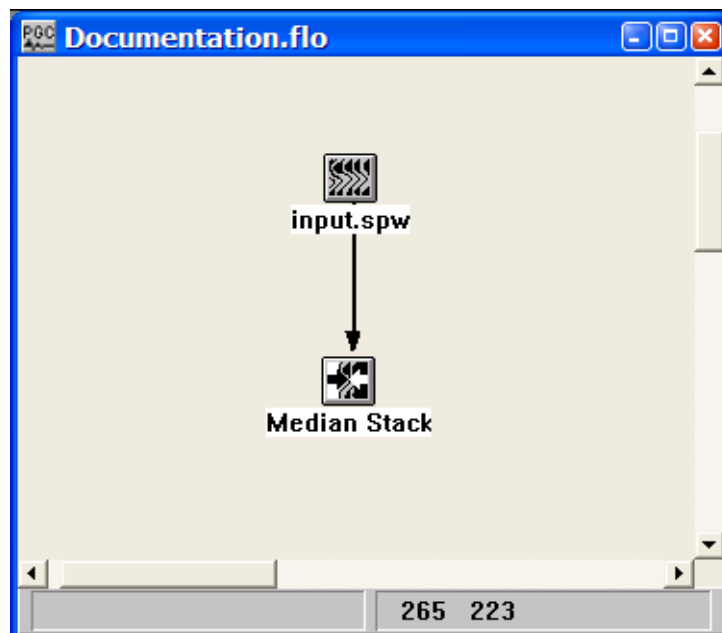
Input Links:

1) Seismic data in any sort order (mandatory).

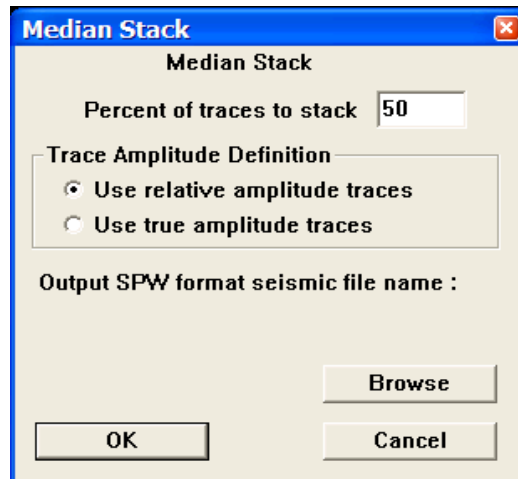
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

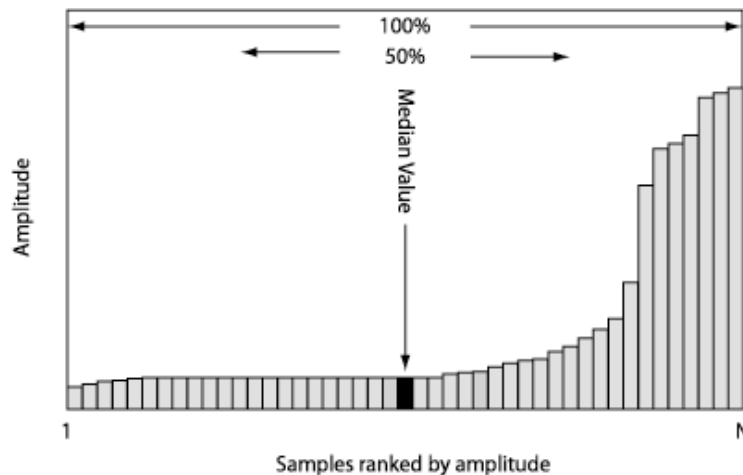
Percent of traces to stack — Enter the percentage of traces to sum into each resulting output trace. A number such as 50 indicates that 50 % of the samples centered on the median sample value will contribute to the summed output sample.

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Browse — Select this button to set the output seismic file name.



Offset Order Stack

Usage:

The Offset Order Stack step allows you to input data sorted in common offset order and output a common offset stack seismic file. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. $\text{fold}^{**} \text{EXP}$). You also specify whether you want to sum relative or absolute amplitude traces.

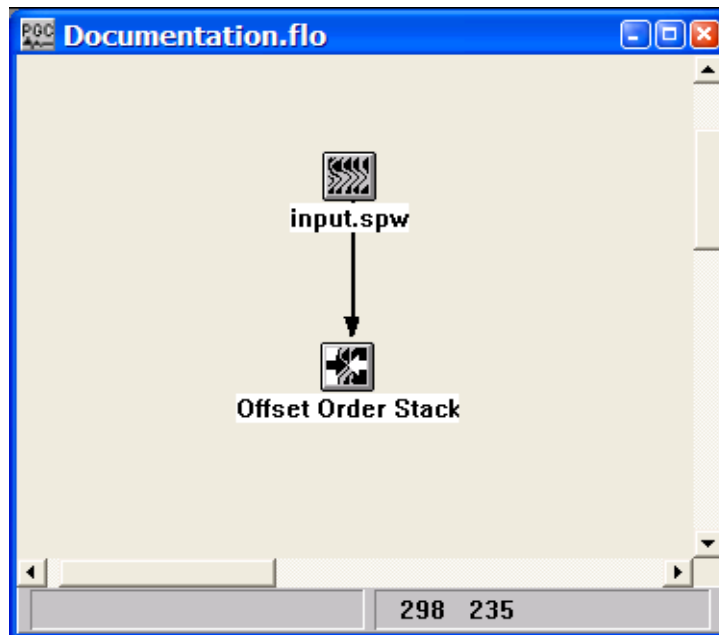
Input Links:

1) Seismic data in common offset sort order (mandatory).

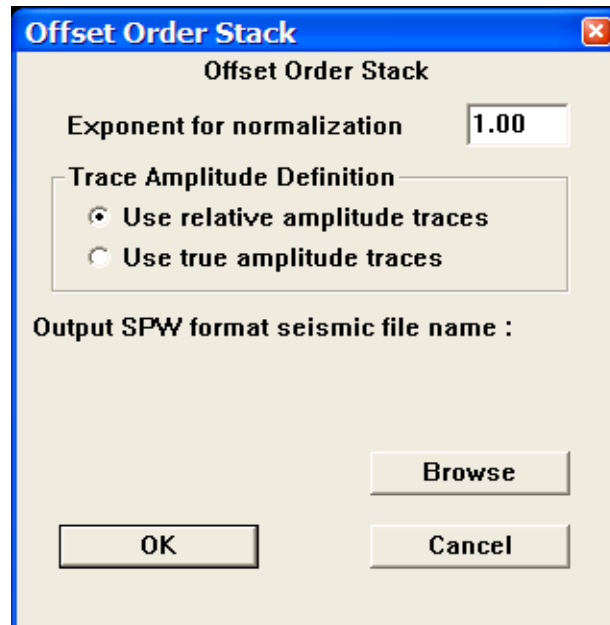
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Browse — Select this button to set the output seismic file name.

Receiver Order Stack

Usage:

The Receiver Order Stack step allows you to input data sorted in common receiver order and output a common receiver stack seismic file. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. $\text{fold} ** \text{EXP}$). You also specify whether you want to sum relative or absolute amplitude traces.

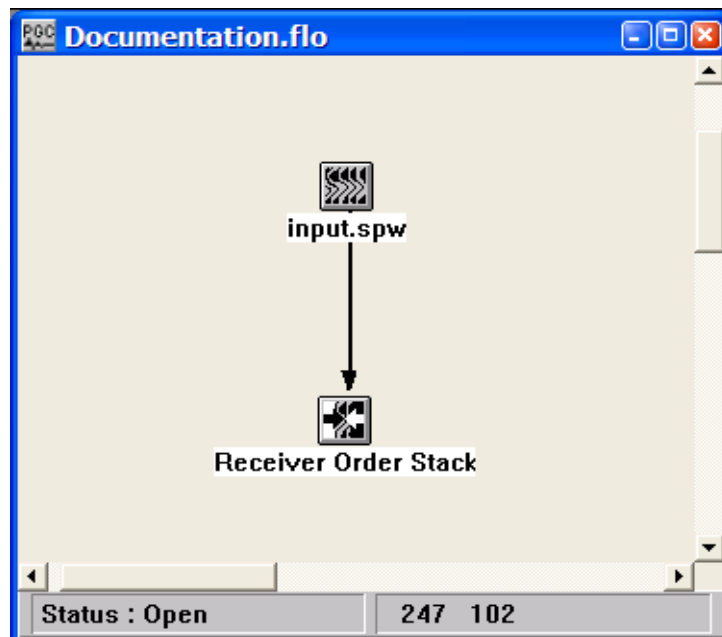
Input Links:

1) Seismic data in common receiver sort order (mandatory).

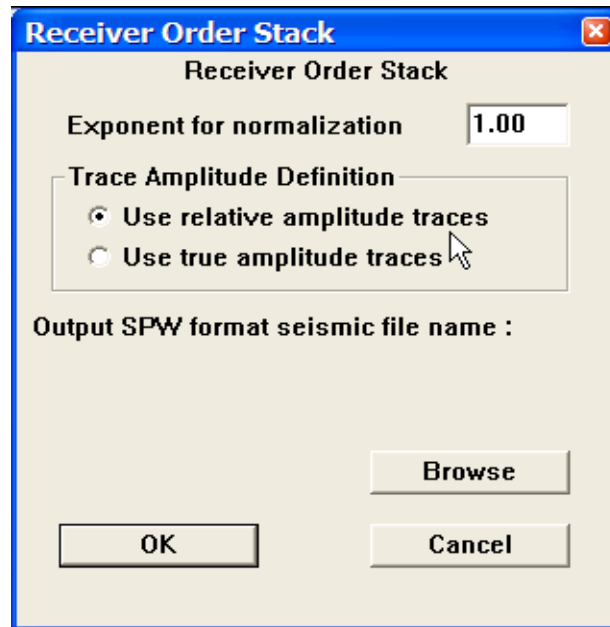
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Browse — Select this button to set the output seismic file name.

Source Order Stack

Usage:

The Source Order Stack step allows you to input data sorted in common source order and output a common source stack seismic file. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. $\text{fold}^{**} \text{EXP}$). You also specify whether you want to sum relative or absolute amplitude traces.

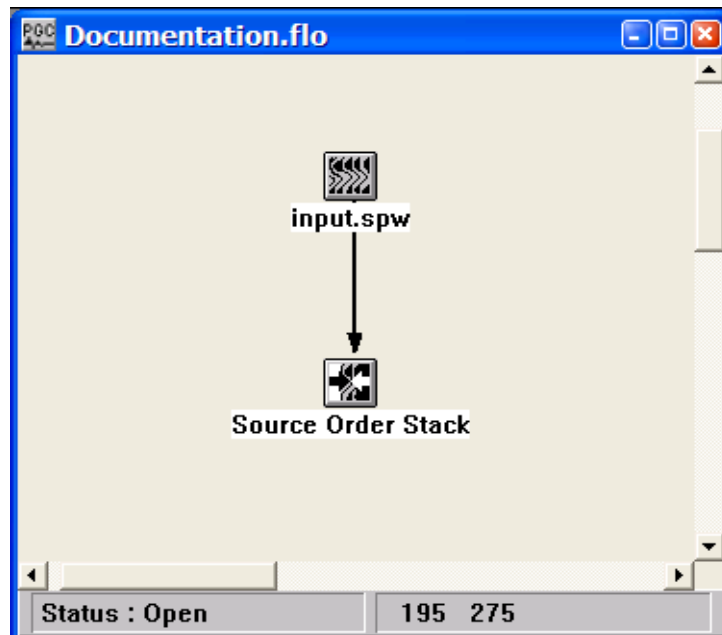
Input Links:

1) Seismic data in common source sort order (mandatory).

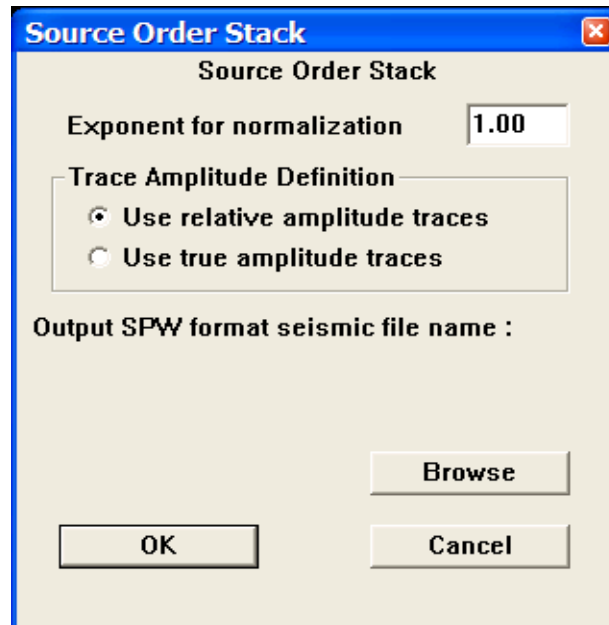
Output Links:

None – This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Browse — Select this button to set the output seismic file name.

Trace Mixing

Usage:

The Trace Mixing step is used to perform a weighted horizontal sum of up to fifteen (15) sequential input traces into a single output trace.

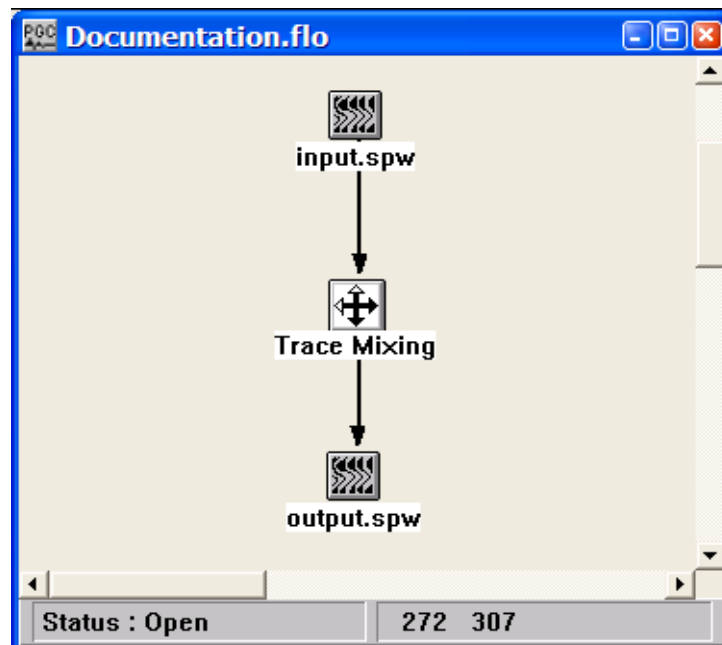
Input Links:

1) Seismic data in any sort order (mandatory).

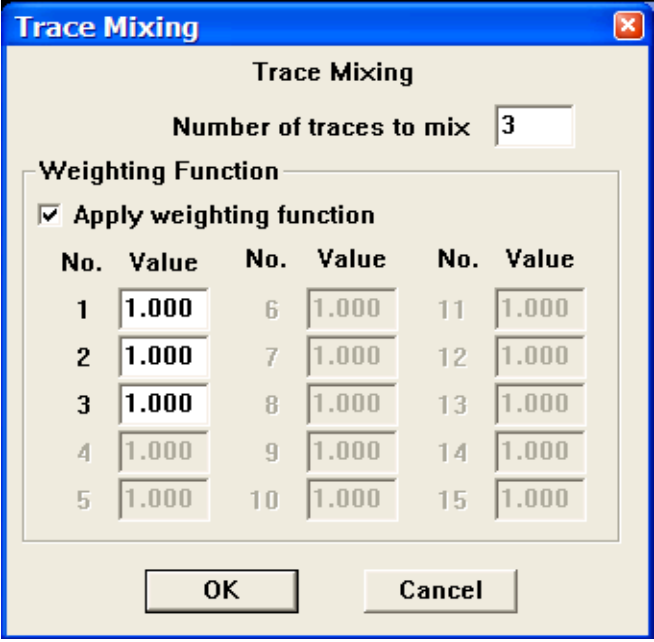
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Trace Mixing" and contains the following elements:

- A label "Trace Mixing" centered at the top.
- A label "Number of traces to mix" followed by a text box containing the value "3".
- A section titled "Weighting Function" containing a checked checkbox labeled "Apply weighting function".
- A table with 15 rows and 2 columns, labeled "No." and "Value". All values are "1.000".
- Buttons for "OK" and "Cancel" at the bottom.

No.	Value	No.	Value	No.	Value
1	1.000	6	1.000	11	1.000
2	1.000	7	1.000	12	1.000
3	1.000	8	1.000	13	1.000
4	1.000	9	1.000	14	1.000
5	1.000	10	1.000	15	1.000

Parameter Description:

Number of traces to mix — Enter the number of traces to mix (blend) into each output trace.

Apply weighting function — If checked, the specified weighting function will be used. Otherwise, each trace contributing to the mix will be equally weighted.

Value — The relative value of the weight for each trace in the mix.

Variable Trace Mix

Usage:

The Variable Trace Mix step is used to perform an unweighted horizontal trace mix of sequential input traces into a single output trace. The number of traces in the mix may vary as a function of trace number in the gather.

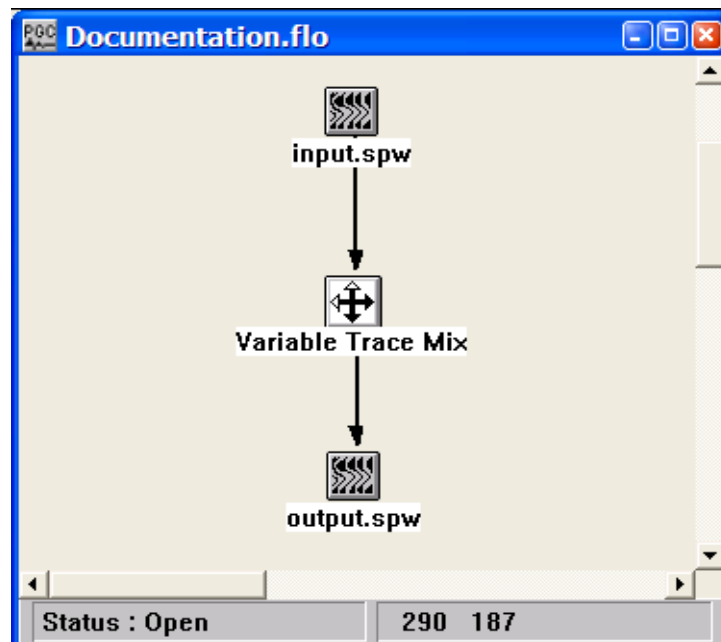
Input Links:

1) Seismic data in any sort order (mandatory).

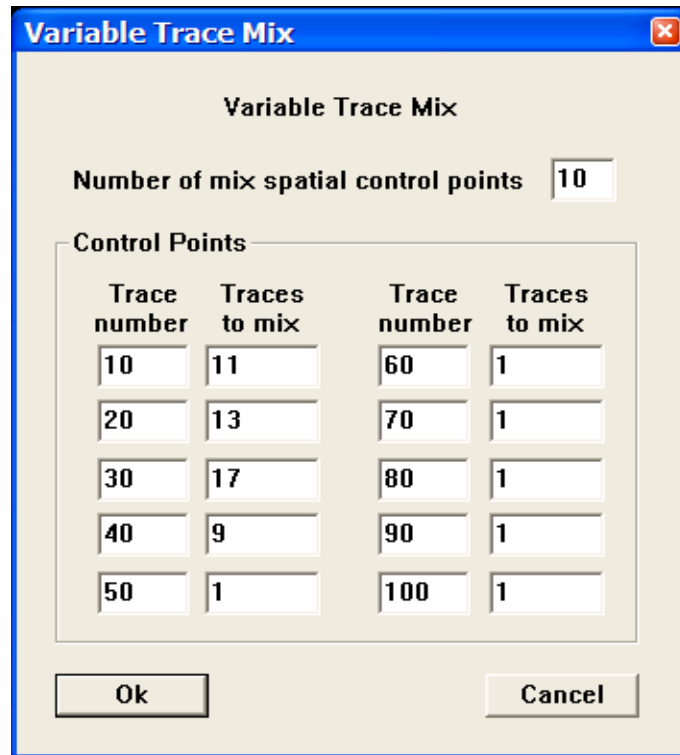
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Variable Trace Mix" and contains a section for "Control Points". It features a table with two columns: "Trace number" and "Traces to mix". The table has 10 rows, with the first 5 rows containing trace numbers 10 through 50 and the last 5 rows containing trace numbers 60 through 100. The "Traces to mix" values are 11, 13, 17, 9, 1, 1, 1, 1, 1, and 1 respectively. The dialog also includes "Ok" and "Cancel" buttons at the bottom.

Trace number	Traces to mix	Trace number	Traces to mix
10	11	60	1
20	13	70	1
30	17	80	1
40	9	90	1
50	1	100	1

Parameter Description:

Number of mix spatial control points — Enter the number of variable spatial control points to be specified for the mix.

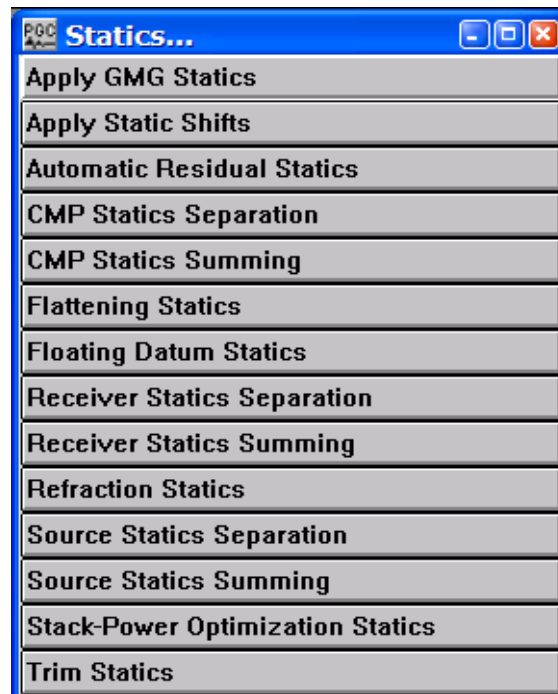
Trace number — Enter a trace number where the number of traces to mix will change.

Traces to mix — Enter the number of traces to mix for this segment of the data.

Statics Steps

This section documents the processing steps available in the Statics Steps category.

Processing steps currently available are:



Apply GMG Statics

Usage:

The Apply GMG Statics step allows you to apply datum statics, refraction statics, and relative statics calculated by Green Mountain Geophysics third party software. The static shift values can be applied in a coarse grain mode or fine grain mode. The coarse grain mode applies static shifts by shifting to the nearest sample in the time domain. The fine grained mode phase shifts your data in the frequency domain, allowing an efficient method of shifting your data in increments less than the sample interval. Finally, the negative of the static values in the card data can be applied.

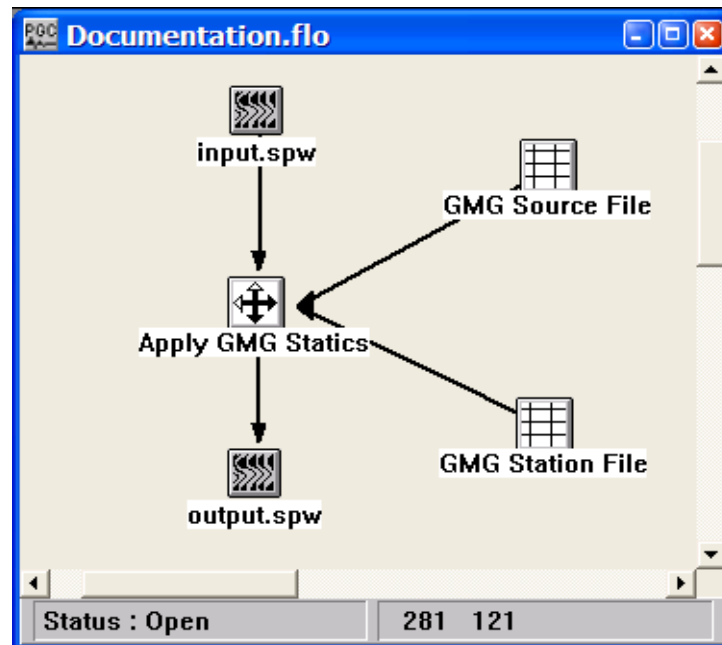
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) GMG Source File (optional).
- 3) GMG Receiver File (optional).

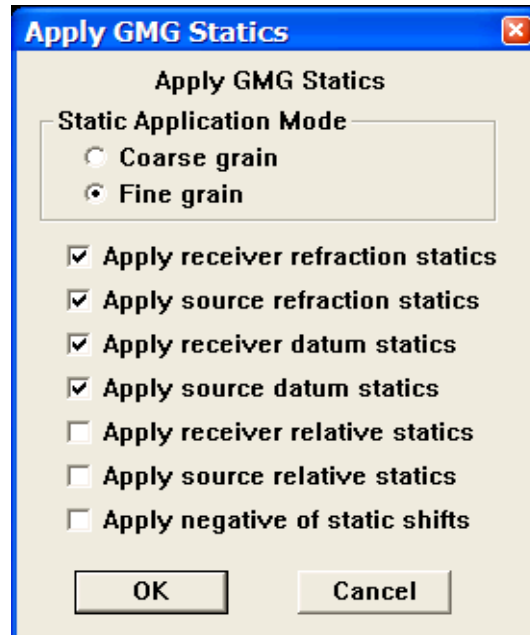
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Static Application Mode — Select the mode of statics application.

Coarse grain — Statics shifts are applied to the nearest discrete sample position.

Fine grain — Statics shifts are applied as a precise phase shift operator in the Fourier domain.

Apply receiver refraction statics — If checked, the receiver refraction statics in the GMG Station file will be applied.

Apply source refraction statics — If checked, the source refraction statics in the GMG Source file will be applied.

Apply receiver datum statics — If checked, the receiver datum statics in the GMG Station file will be applied.

Apply source datum statics — If checked, the source datum statics in the GMG Source file will be applied.

Apply receiver relative statics — If checked, the receiver relative statics in the GMG Station file will be applied.

Apply source relative statics — If checked, the source relative statics in the GMG Source file will be applied.

Apply negative of static shifts — If this is checked, the negative of the static values will be applied.

Apply Static Shifts

Usage:

The Apply Static Shifts step allows you to apply source, receiver, CMP, and trace statics calculated by any of the various statics processing steps. The static shift values can be applied in a coarse grain mode or fine grain mode. The coarse grain mode applies static shifts by shifting to the nearest sample in the time domain. The fine grained mode phase shifts your data in the frequency domain, allowing an efficient method of shifting your data in increments less than the sample interval.

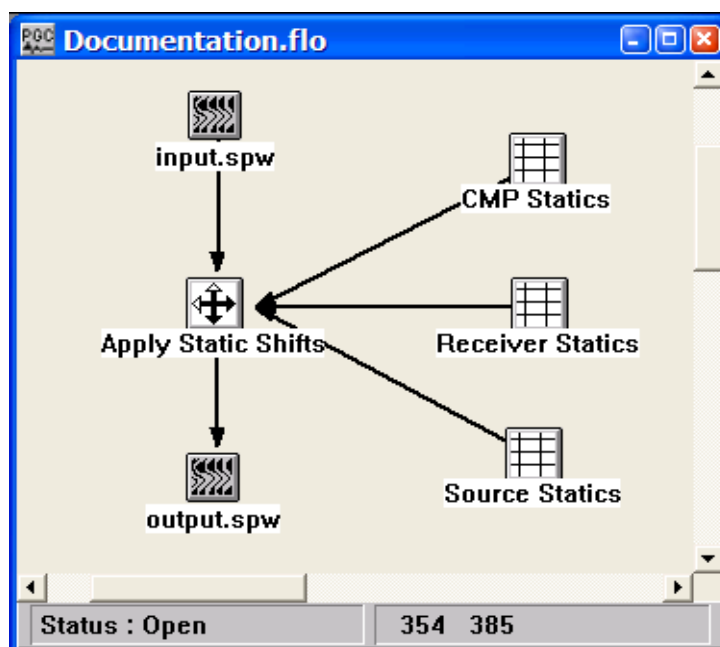
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) CMP Statics cards (optional).
- 3) Receiver Statics cards (optional).
- 4) Source Statics cards (optional).
- 5) Trace Statics cards (optional).

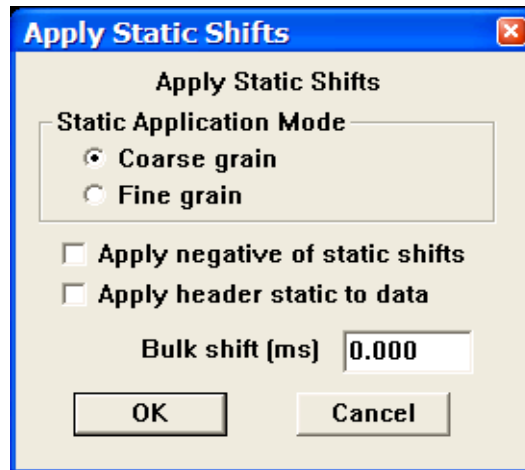
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Static Application Mode — Select the mode of statics application.

Coarse grain — Statics shifts are applied to the nearest discrete sample position.

Fine grain — Statics shifts are applied as a precise phase shift operator in the Fourier domain.

Apply negative of static shifts — If this is checked, the negative of the static values will be applied.

Apply header statics — If this is checked, the value in the Static Time field in the trace header spreadsheet will be applied to the seismic trace.

Bulk shift in ms — Enter a constant statics shift in milliseconds to apply to all the seismic data traces.

Automatic Residual Statics

2-D Only

Usage:

The Automatic Residual Statics step uses a least-squares linear inversion routine to decompose traveltimes into source, receiver, CMP, and offset related terms. The pick times input to the inversion are picked automatically using cross correlation in a specified time window. You control the window of data for analysis as well as the maximum allowable static that can be computed. A damping filter can be applied to suppress any long period effects associated with the residual statics solution. Options exist for removing either or both the residual normal moveout (RNMO) term and a linear trend from the statics solution. Surface consistent source and receiver statics are generated and output for later application using the Apply Statics step.

Input Links:

1) Seismic data - NMO corrected CMP gathers (mandatory).

Output Links:

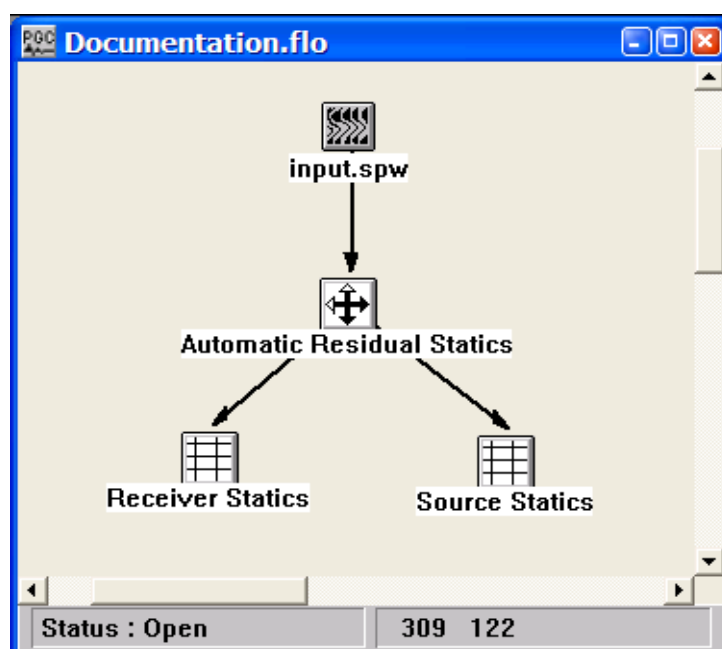
1) Source Statics cards (mandatory).

2) Receiver Statics cards (mandatory).

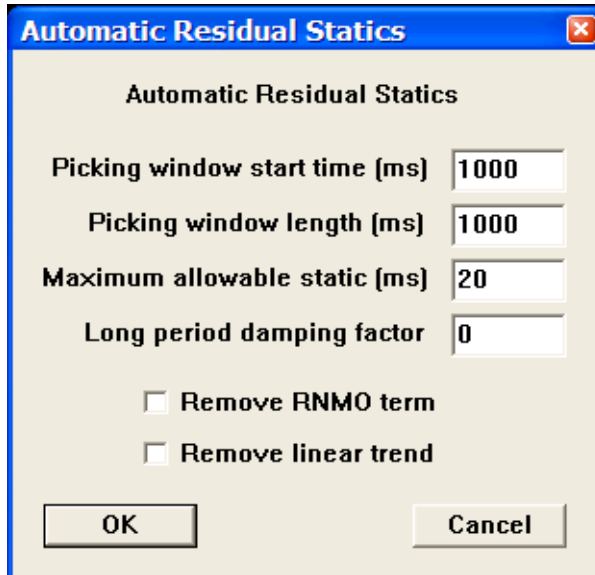
Reference:

Wiggins, R. A., et al., 1976, Residual statics analysis as a general linear inverse problem: Geophysics, vol. 50, no. 11, p. 2172ff.
See Technical Note TN-ResSt.doc

Example Flowchart:



Step Parameter Dialog:

A screenshot of a software dialog box titled "Automatic Residual Statics". The dialog has a blue title bar with a close button (X) in the top right corner. The main area has a light beige background. It contains four labeled input fields: "Picking window start time (ms)" with a value of 1000, "Picking window length (ms)" with a value of 1000, "Maximum allowable static (ms)" with a value of 20, and "Long period damping factor" with a value of 0. Below these fields are two unchecked checkboxes: "Remove RNMO term" and "Remove linear trend". At the bottom are two buttons: "OK" and "Cancel".

Automatic Residual Statics	
Picking window start time (ms)	1000
Picking window length (ms)	1000
Maximum allowable static (ms)	20
Long period damping factor	0
<input type="checkbox"/> Remove RNMO term	
<input type="checkbox"/> Remove linear trend	
OK	Cancel

Parameter Description:

Picking window start time (ms) — Enter the time in milliseconds of the start of the cross correlation window for picking the times for use in the residual statics calculation.

Picking window length (ms) — Enter the length of the correlation window in milliseconds for picking the times for use in the residual statics calculation. {>0}

Maximum allowable static (ms) — Enter the maximum allowable static shift pick (number of correlation lags) in milliseconds. {>0}

Long period damping factor — This parameter controls the degree the periodic components in the statics solution longer than a spread length will be damped. {-8,8}

Remove RNMO term — If checked, residual normal moveout (RNMO term) will be included in the matrix calculations of the solution. If this term is not included in the matrix, then the RNMO will affect the source and receiver static solutions.

Remove linear trend — If checked, a least squares linear fit will be removed from the final statics solution.

CMP Statics Separation

Usage:

The CMP Statics Separation step inputs CMP Statics card data and separates the statics into long and short period components. The operator is currently a 2-D operator which operates in the in-line direction.

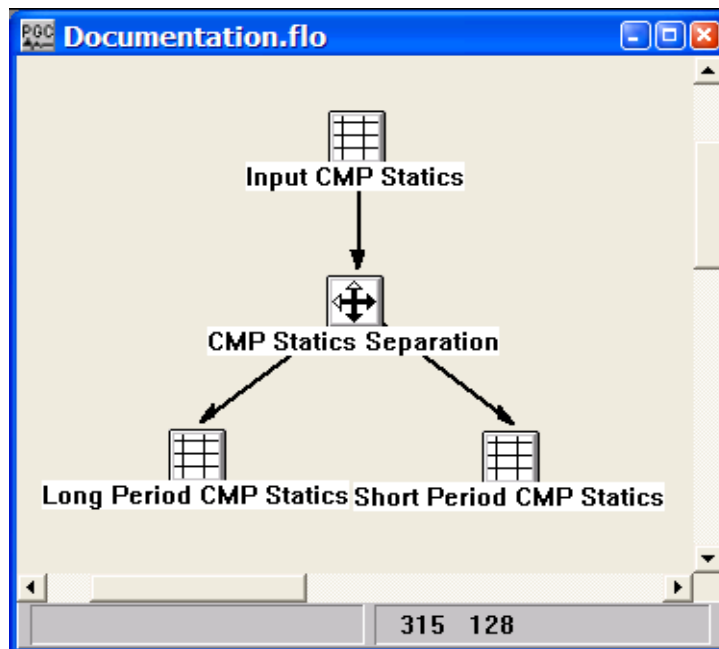
Input Links:

1) CMP Statics cards (mandatory).

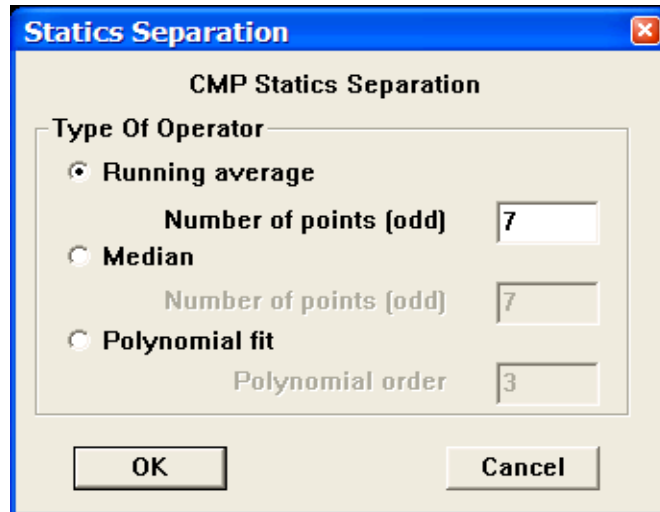
Output Links:

1) CMP Statics cards (mandatory).
2) CMP Statics cards (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Statics Separation" with a standard Windows-style title bar (blue with a close button). The main content area is titled "CMP Statics Separation". It contains a section labeled "Type Of Operator" with three radio button options: "Running average" (which is selected), "Median", and "Polynomial fit". To the right of the "Running average" option is a text input field containing the number "7", labeled "Number of points (odd)". To the right of the "Median" option is another text input field containing the number "7", also labeled "Number of points (odd)". To the right of the "Polynomial fit" option is a text input field containing the number "3", labeled "Polynomial order". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Type Of Operator - defines the type of function to use for defining the fit to the long period statics solution.

Running Average — This selects an averaging smoothing operator.

Number of points (odd) — Enter the number of points in the running average smoother.

Median — This selects a median smoothing operator.

Number of points (odd) — Enter the number of points in the median smoother.

Polynomial fit — This selects a polynomial fitting operator to approximate the long period statics.

Polynomial order — Enter the order of the orthogonal polynomials to fit to the data.

CMP Statics Summing

Usage:

The CMP Statics Summing step will sum together two input CMP Statics card data files into a single output CMP Statics card data file.

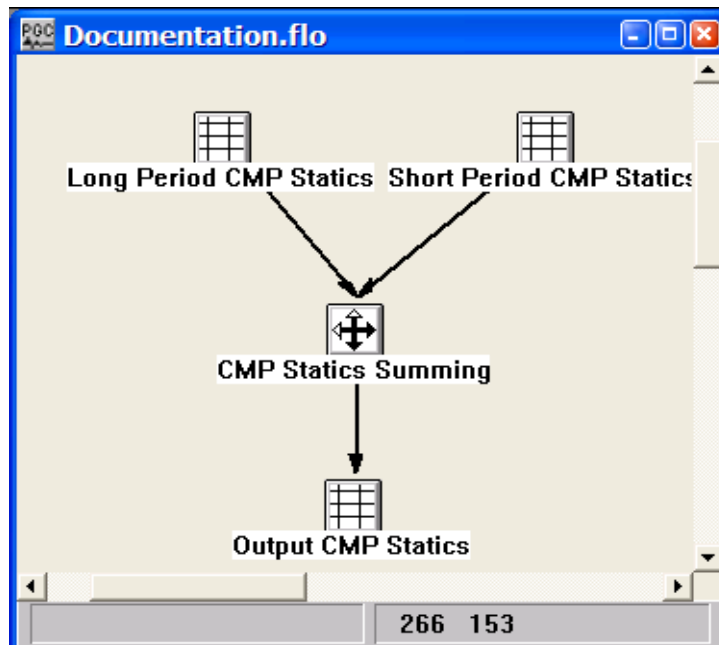
Input Links:

- 1) CMP Statics cards (mandatory).
- 2) CMP Statics cards (mandatory).

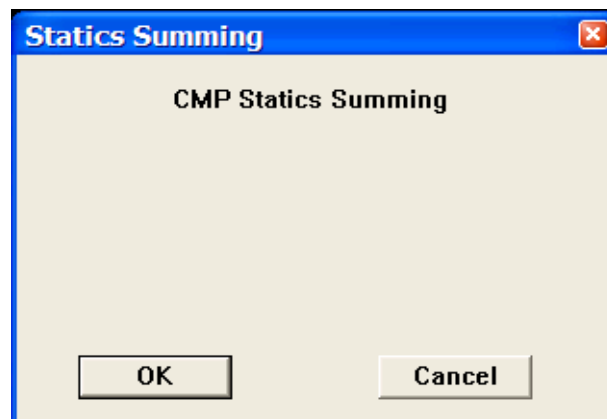
Output Links:

- 1) CMP Statics cards (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Flattening Statics

Usage:

The Flattening Statics step inputs a seismic data file and a corresponding Horizon File pick card, and outputs a set of CMP Static cards. You can then apply these CMP statics using the Apply Statics step to flatten the picked horizon on a stack to the datum you specify. You have the option of applying a smoothing operation to the set of CMP static time shifts using a running average, median, or polynomial smoothing operator.

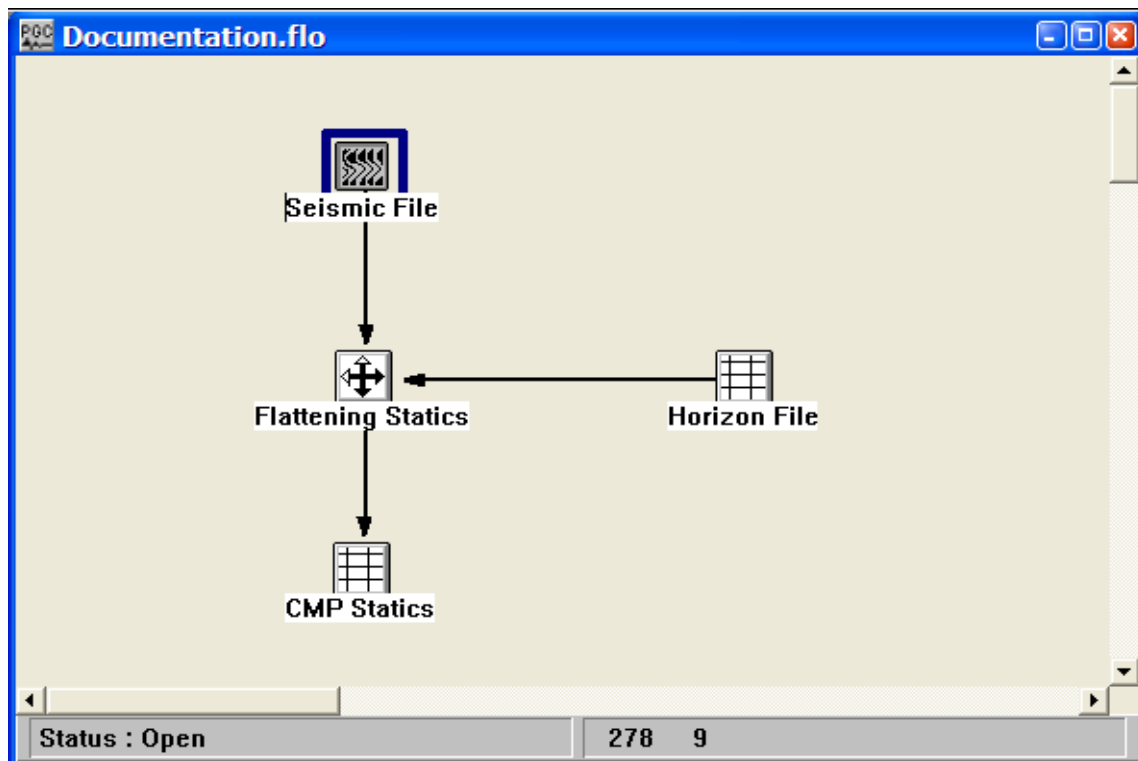
Input Links:

- 1) Seismic File (mandatory).
- 2) Horizon File cards (mandatory).

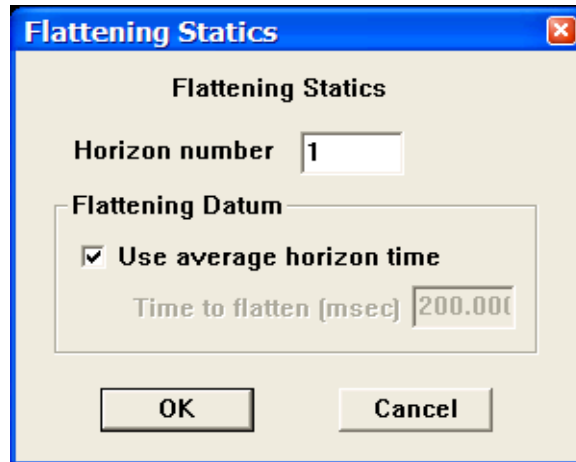
Output Links:

- 1) CMP Statics cards (mandatory).

Example Flowchart:



Step Parameter Dialog:

A screenshot of a software dialog box titled "Flattening Statics". The dialog has a blue title bar with a close button (X) in the top right corner. The main area is light beige. It contains a label "Horizon number" followed by a text input field containing the value "1". Below this is a section titled "Flattening Datum" enclosed in a thin grey border. Inside this section, there is a checked checkbox labeled "Use average horizon time". Below the checkbox is a label "Time to flatten (msec)" followed by a text input field containing the value "200.000". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Horizon number – Enter the number of the horizon in the Horizon File card used to determine the static shifts.

Flattening Datum – Statics can be computed that will flatten the chosen horizon to the average horizon time or to a specified constant time.

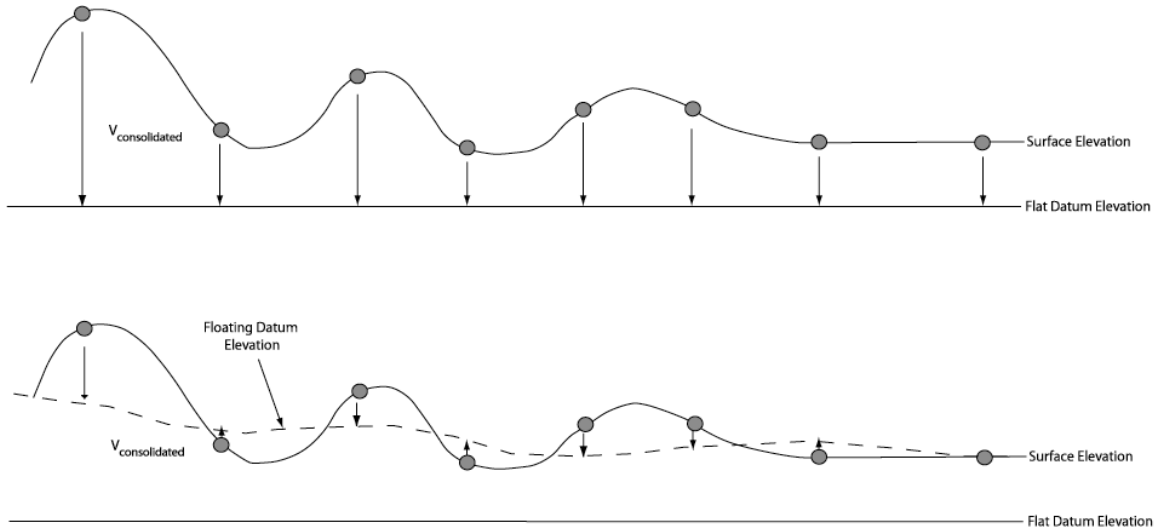
Use average horizon time – If checked, the CMP statics card will contain statics that flatten the chosen horizon to a time that is the average of all times defining the horizon.

Time to flatten (msec) – If chosen, the CMP statics card will contain statics which flatten the chosen horizon to the specified constant time.

Floating Datum Statics

Usage:

The Floating Datum Statics step inputs the trace headers from a Seismic Data file and outputs a set of Source and Receiver static files that adjust the data to a floating datum, and CMP static file that adjusts the data from the floating datum to a flat datum. Alternatively, the Source and Receiver statics can be computed that adjust the surface data directly to a flat datum. In both cases, the statics are applied using the Apply Statics step.



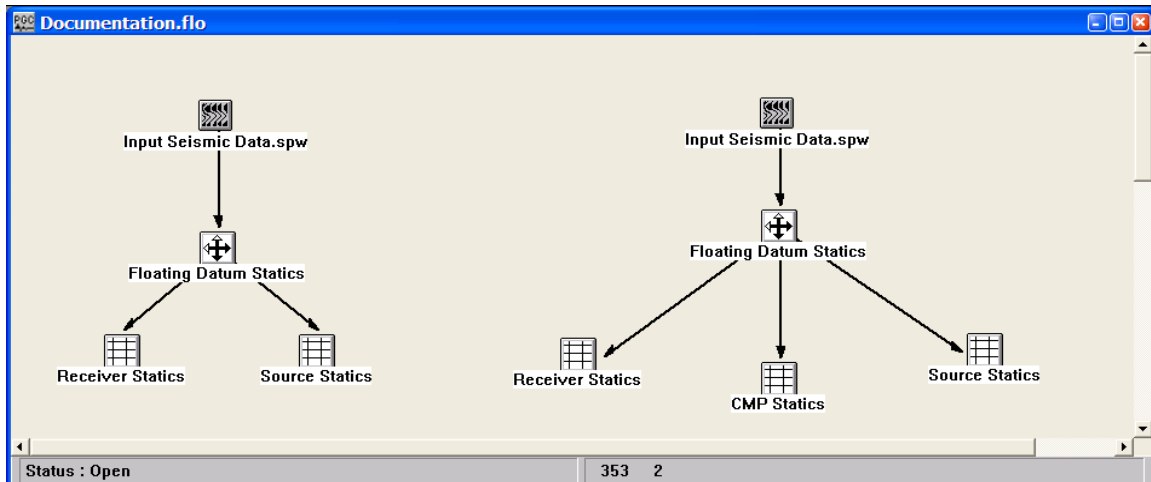
Input Links:

- 1) Seismic data file in any sort order (mandatory).

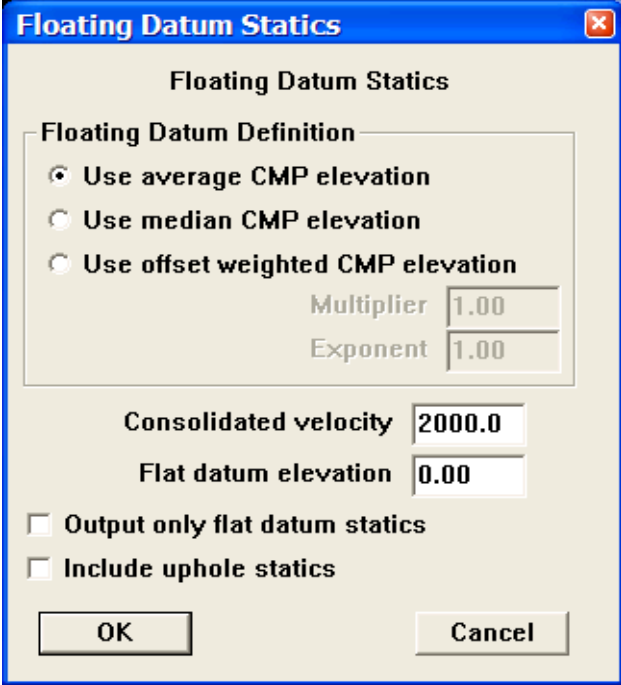
Output Links:

- 1) Source Statics cards (mandatory).
- 2) Receiver Statics cards (mandatory).
- 3) CMP Statics cards (optional, in the case of correction to a Floating Datum).

Example Flowcharts:



Step Parameter Dialog:



The image shows a software dialog box titled "Floating Datum Statics". It contains a section for "Floating Datum Definition" with three radio button options: "Use average CMP elevation" (selected), "Use median CMP elevation", and "Use offset weighted CMP elevation". Below these are input fields for "Multiplier" and "Exponent", both set to "1.00". Further down are input fields for "Consolidated velocity" (set to "2000.0") and "Flat datum elevation" (set to "0.00"). At the bottom are two unchecked checkboxes: "Output only flat datum statics" and "Include uphole statics". "OK" and "Cancel" buttons are at the very bottom.

Parameter Description:

Floating Datum Definition - defines the type of function to use for defining the floating datum.

Average — This selects an average operator.

Median — This selects a median smoothing operator.

Offset weighted CMP Elevation — If selected, a weighted CMP elevation function of the form $\text{weight} = \text{multiplier} * (\text{offset} ** \text{exponent})$ will be used to define the datum.

Multiplier — Enter the multiplier of the weighting function.

Exponent — Enter the exponent of the weighting function.

Consolidated velocity — Enter the consolidated, or replacement velocity.

Flat datum elevation — Enter the elevation of the flat datum to use.

Output only flat datum statics — If checked, only the flat datum statics will be output. Source and receiver statics will be from the surface to the flat datum. The CMP statics will be output as 0.

Include uphole static — If checked, the uphole static will be included.

Receiver Statics Separation

Usage:

The Receiver Statics Separation step inputs Receiver Statics card data and separates the statics into long and short period components. The current separation operator is a 2-D operator that operates in the in-line direction. The first output link will contain the long period statics, and the second output link will contain the short period statics.

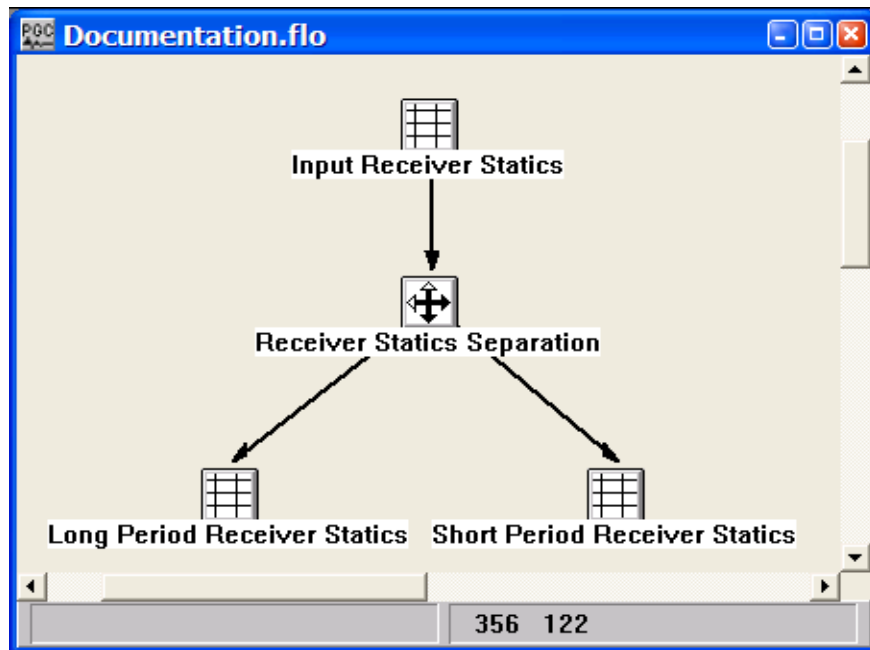
Input Links:

- 1) Receiver Statics cards (mandatory).

Output Links:

- 1) Receiver Statics cards (mandatory). The first link contains the long period statics.
- 2) Receiver Statics cards (mandatory). The second link contains the short period statics.

Example Flowchart:



Step Parameter Dialog:

Statics Separation

Receiver Statics Separation

Type Of Operator

☒ Running average
Number of points (odd)

☐ Median
Number of points (odd)

☐ Polynomial fit
Polynomial order

OK Cancel

Parameter Description:

Type Of Operator - defines the type of function to use for defining the fit to the long period statics solution.

Running Average — This selects an averaging smoothing operator.

Number of points (odd) — Enter the number of points in the running average smoother.

Median — This selects a median smoothing operator.

Number of points (odd) — Enter the number of points in the median smoother.

Polynomial fit — This selects a polynomial fitting operator to approximate the long period statics.

Polynomial order — Enter the order of the orthogonal polynomials to fit to the data.

Receiver Statics Summing

Usage:

The Receiver Statics Summing step will sum together two input Receiver Statics card data files into a single output Receiver Statics card data file.

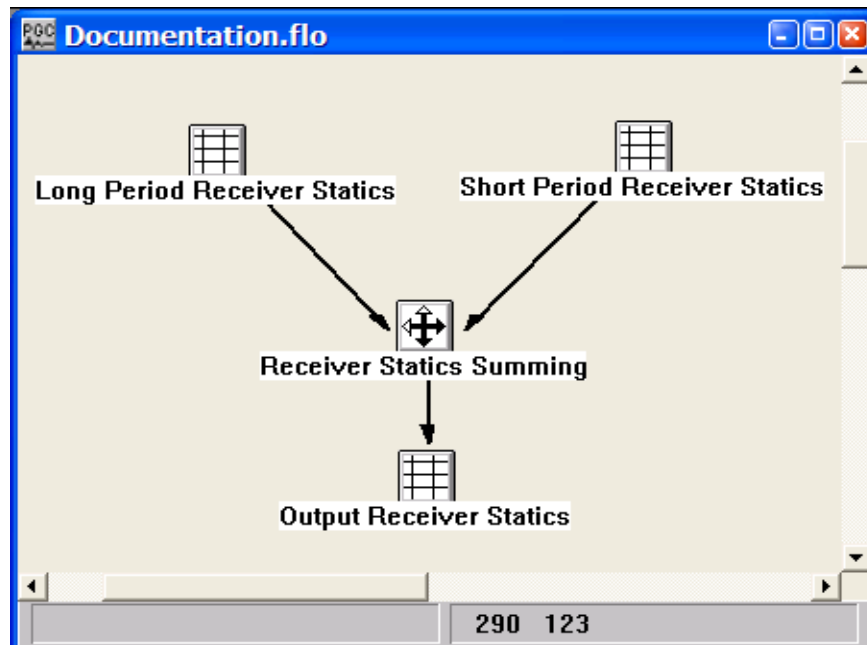
Input Links:

- 1) Receiver Statics cards (mandatory).
- 2) Receiver Statics cards (mandatory).

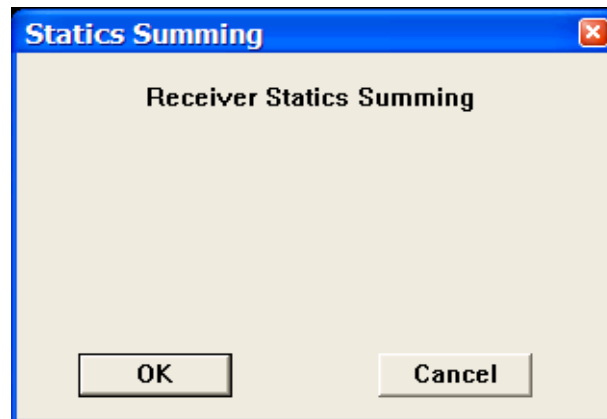
Output Links:

- 1) Receiver Statics cards (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Refraction Statics

(2D Only)

Usage:

The Refraction Statics step generates 2D Source and Receiver Statics card data files based on a one or two layer refraction statics solution. The step requires as input a seismic data file with complete geometry header information and a First Break Time Picks card.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) First Break Time Pick card (mandatory).

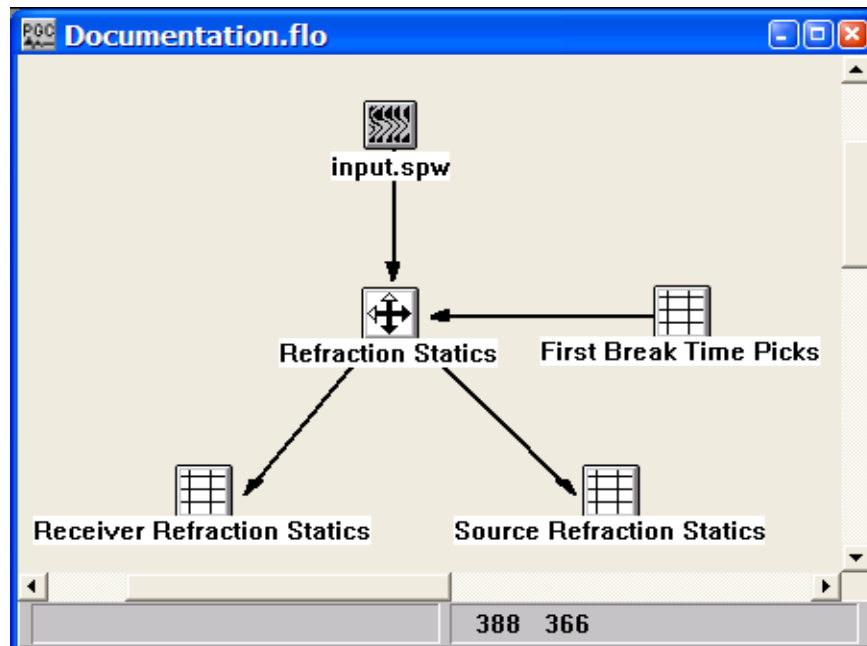
Output Links:

- 1) Receiver Statics cards (mandatory).
- 2) Source Statics cards (mandatory).

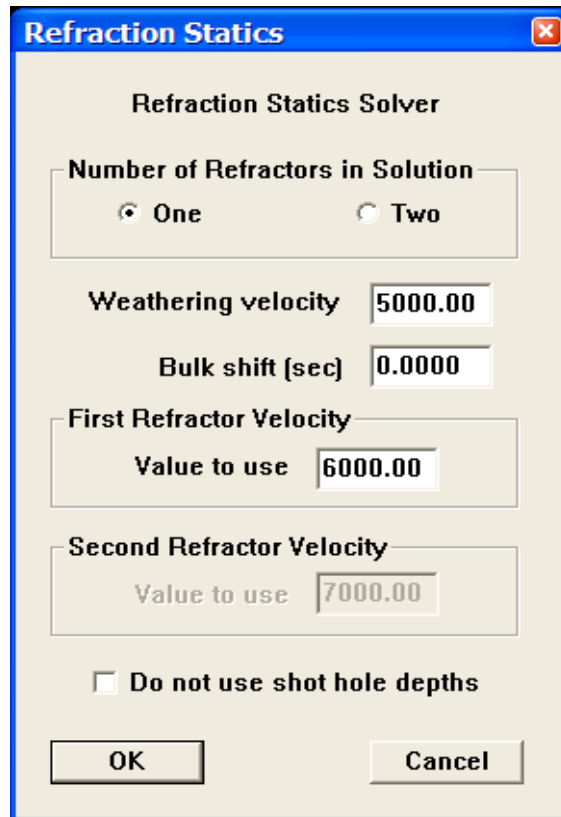
Reference:

Farrell, R. C., and Euwema, R. M., 1984, Refraction Statics, IEEE, 72, no.10, p 1316-1329.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Refraction Statics". Inside the dialog, the title "Refraction Statics Solver" is centered. Below it, there is a section titled "Number of Refractors in Solution" with two radio button options: "One" (which is selected) and "Two". Below this, there are three input fields: "Weathering velocity" with a value of "5000.00", "Bulk shift (sec)" with a value of "0.0000", and "First Refractor Velocity" with a value of "6000.00". Below these is another input field for "Second Refractor Velocity" with a value of "7000.00". At the bottom, there is a checkbox labeled "Do not use shot hole depths" which is currently unchecked. At the very bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Number of Refractors in Solution – Select whether to compute a one- or a two-layer refraction static solution.

Weathering velocity – Enter the value of the weathering (i.e. overburden) velocity.

Bulk Shift – Enter a constant statics shift in milliseconds to apply to all the seismic data traces.

First Refractor Velocity – Enter the constant value to be used for the first refractor velocity.

Second Refractor Velocity – Enter the constant value to be used for the second refractor velocity.

Do not use shot hole depths – If checked, the value in the Source Depth field of the trace header spreadsheet will not be used when computing the refraction static solution.

Source Statics Separation

Usage:

The Source Statics Separation step inputs Source Statics card data and separates the statics into long and short period components. The current separation operator is a 2-D operator that operates in the in-line direction. The first output link will contain the long period statics, and the second output link will contain the short period statics.

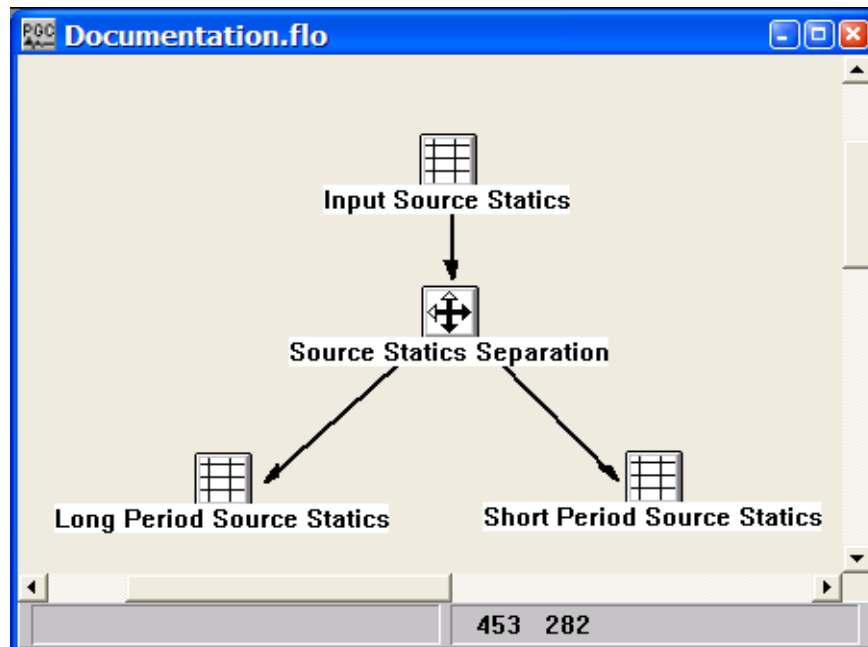
Input Links:

- 1) Source Statics cards (mandatory).

Output Links:

- 1) Source Statics cards (mandatory). The first link contains the long period statics.
- 2) Source Statics cards (mandatory). The second link contains the short period statics.

Example Flowchart:



Step Parameter Dialog:

Statics Separation

Source Statics Separation

Type Of Operator

☒ Running average
Number of points (odd) 7

☐ Median
Number of points (odd) 7

☐ Polynomial fit
Polynomial order 3

OK Cancel

Parameter Description:

Type Of Operator - defines the type of function to use for defining the fit to the long period statics solution.

Running Average — This selects an averaging smoothing operator.

Number of points (odd) — Enter the number of points in the running average smoother.

Median — This selects a median smoothing operator.

Number of points (odd) — Enter the number of points in the median smoother.

Polynomial fit — This selects a polynomial fitting operator to approximate the long period statics.

Polynomial order — Enter the order of the orthogonal polynomials to fit to the data.

Source Statics Summing

Usage:

The Source Statics Summing step will sum together two input Source Statics card data files into a single output Source Statics card data file.

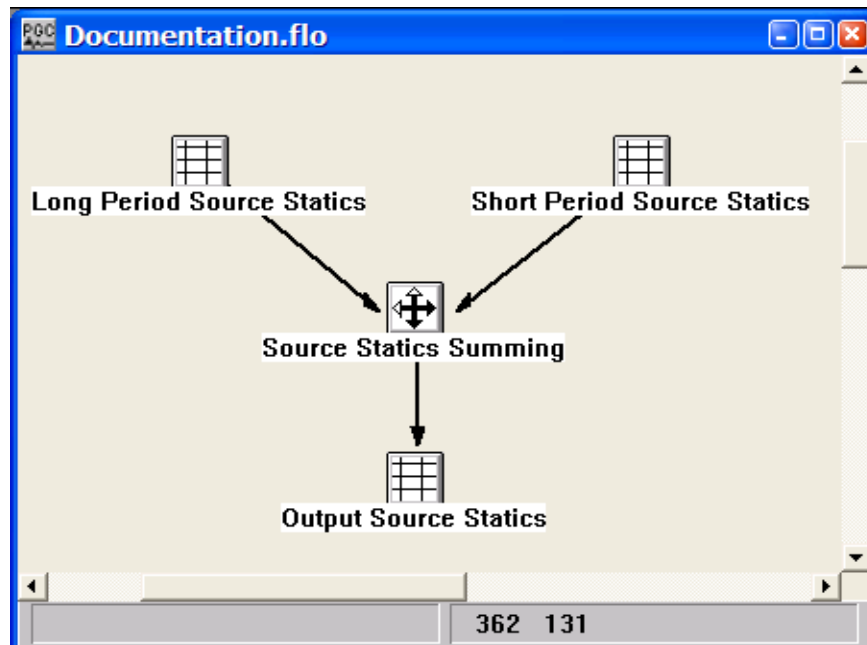
Input Links:

- 1) Source Statics cards (mandatory).
- 2) Source Statics cards (mandatory).

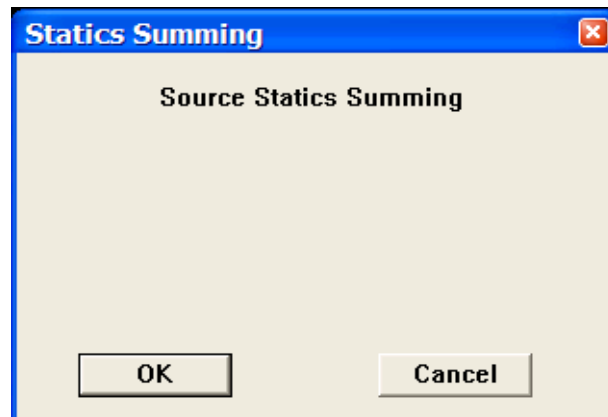
Output Links:

- 1) Source Statics cards (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Stack-Power Optimization Statics

2-D/3-D

Usage:

The Stack-Power Optimization Statics step calculates surface consistent residual static time corrections by maximizing the power in the stack. Source and receiver super traces are cross-correlated with corresponding CMP super traces to determine a surface consistent static correction.

For 3-D, the input seismic file is required to be a CMP binned seismic volume. For 2-D, the input seismic file can be in any sort order, as long as Geometry Definition has been applied. Binning geometry for 3-D surveys should include all shot and receiver locations. Set the bin origin at the minimum source, receiver or CMP location.

Output stacks may be generated to evaluate the quality of the statics. The stacks show the sorted input file stacked in the analysis window with static corrections applied. The stacks are accumulated in the frequency domain and back transformed for the final stack trace. Numerical round off may cause slight variations when compared with stacks from the CMP Stack processing step. Stack type may be source, receiver or CMP.

Analysis stacks at specified intervals may be created to evaluate optimal convergence. The analysis stacks are a selected subset of source, receiver or CMP lines output to a specified directory. A unique filename suffix is assigned automatically for each iteration. Small subsets are recommended to reduce disk storage requirements. Full volume source, receiver and CMP stacks with user specified filename may be output for the final iteration.

An option exists to output to the console a summary of the static corrections generated at the end of each iteration. The source and receiver statics output by the Stack-Power Optimization Statics Step are applied with the Apply Statics step.

Input Links:

- 1) Seismic data, 3-D binned or 2-D in any sort order with geometry applied (mandatory).

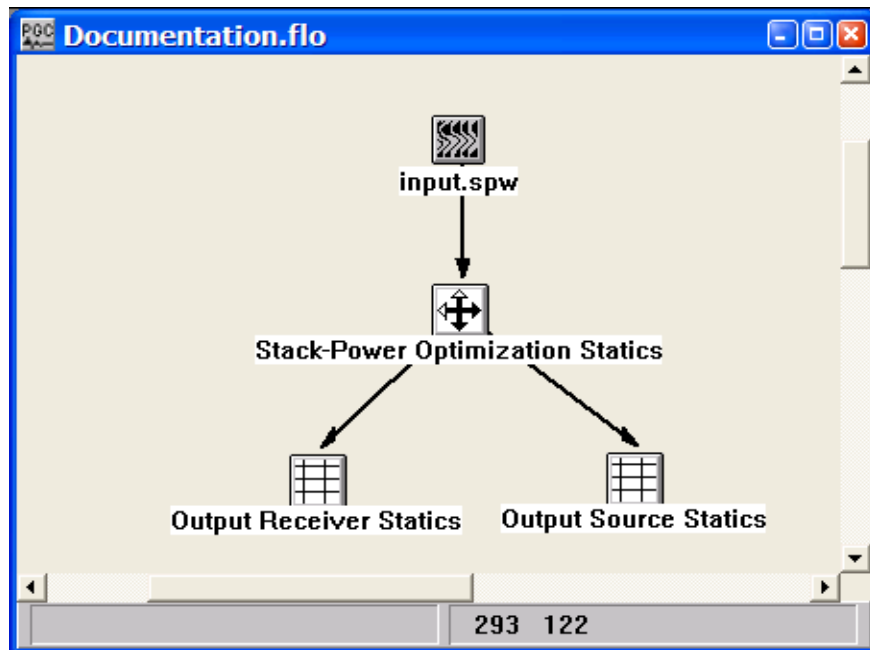
Output Links:

- 1) Source statics cards (mandatory).
- 2) Receiver statics cards (mandatory).
- 3) Selected stack analysis files (optional).
- 4) Selected stack volume (optional).

Reference:

Ronen J., and Claerbout, J., 1985, Surface-consistent residual statics estimation by stack-power maximization, *Geophysics*, vol. 50, no. 12, p. 2759-2767.

Example Flowcharts:



Step Parameter Dialog:

Stack-Power Optimization Statics

Control Parameters

Number of iterations: 10

Maximum allowable static (ms): 20.00000

Analysis window length (ms): 1000

Analysis start time (ms): 1000

Maximum static offset: 2000.0

Median Filter

☐ Median filter static values

Every Nth iteration N = 5

Inline operator length: 10

Crossline operator length: 10

Iteration Convergence Value

☐ End iteration based on static value

Static value for exit (ms): 3.00000

Analysis Profiles

☐ Build intermediate file(s)

Every Nth iteration N = 5

Output Line Range

Limit	Min line	Max line	Line interval
<input type="checkbox"/>	0.0	0.0	1

Output stack type: None [Browse] ☒ Verbose console mode

Output SPW format seismic file name :

OK Cancel

Parameter Description:

Control Parameters -

Number of iterations — Maximum number of iterations for the processing step.

Maximum allowable static — Static shifts for each iteration are not allowed to exceed this value in ms. The final static is the sum of statics at each iteration. The total static may exceed the maximum allowable static per iteration.

Analysis window length — Correlation window size for stack-power evaluation in ms. The window starts at 'Analysis start time'.

Analysis start time — Start time for correlation window in ms.

Maximum static offset — Offsets greater than this value in feet or meters are not included in the stacked sections. A warning appears in the console window if the maximum-static offset criteria results in the removal of more than 95% of the stack trace fold

Median filter static values — If checked, a running median spatial filter is applied to each sample. The filter is an effective way to remove spikes. The operator size is specified along inline and crossline directions. The crossline operator size is restricted to 1 for 2-D seismic data.

Every Nth iteration — Apply the median filter at this iteration interval. A value of 1 applies the filter every iteration.

Inline operator length — Spatial size of median filter along the inline direction in samples.

Crossline operator length — Spatial size of median filter along the crossline direction in samples. Restricted to 1 for 2-D seismic data.

End iteration based on static value — If checked, stop the process when the maximum static shift for the iteration is less than the specified value.

Static value for exit — Maximum static in ms.

Build intermediate files — If checked, intermediate analysis profiles are written to the directory specified by the 'Output SPW format seismic file name' selection. Suffices are appended automatically based on iteration number. The naming convention appends _tmp[iteration number] to the output seismic file name, where [iteration number] is an integer from 1 to the number of iterations. Files are overwritten on subsequent iterations. Intermediate files are output only over the analysis window and are used to judge section quality for the output iteration. The analysis files are recommended to be a subset of the full volume to reduce disk storage requirements. A full volume stack is output for the final iteration.

Iteration interval — Intermediate files are output for every Nth iteration.

Output Line Range — If the limit box is checked, analysis files are built for lines between the min/max line values at the line interval. Min/Max line and line interval is restricted to be 1 for 2-D seismic. If the limit box is unchecked, only the line interval is applied to the output stack starting at the first line.

Output Stack Type — Select the output stack type. Stack type may be CMP, source, receiver or none.

Verbose console mode — If this box is checked, static shifts for each unique line and location number are summarized for each iteration in the console window.

Output SPW format seismic file name — The output file name for the final stack. The file name is specified using the Browse button.

Surface Consistent Statics

Usage:

The Surface Consistent Statics step calculates source and receiver residual statics using a Gauss-Seidel iterative method to solve for the source static, receiver static, structure term, and residual NMO) that provide a best fit to the linear traveltime equations in a least-squares sense. linear inversion routine to decompose traveltime equations into source, receiver, CMP, and offset related terms. The pick times input to the inversion are picked automatically using cross correlation in a specified time window. You control the window of data for analysis as well as the maximum allowable static that can be computed. A damping filter can be applied to suppress any long period effects associated with the residual statics solution. Options exist for removing either or both the residual normal moveout (RNMO) term and a linear trend from the statics solution. The source and receiver statics output by the Surface Consistent Residual Statics Step are applied with the Apply Statics step.

Input Links:

1) Seismic data - NMO corrected CMP gathers (mandatory).

Output Links:

1) Source Statics cards (mandatory).

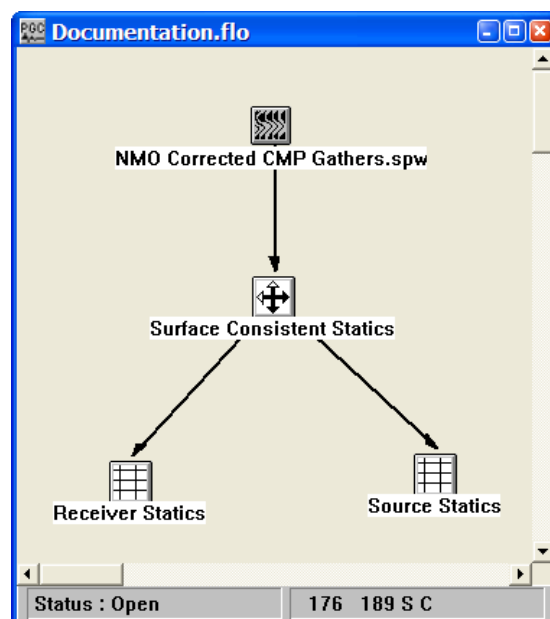
2) Receiver Statics cards (mandatory).

Reference:

Wiggins, R. A., et al., 1976, Residual statics analysis as a general linear inverse problem: Geophysics, vol. 50, no. 11, p. 2172ff.

See Technical Note TN-ResSt.doc

Example Flowchart:



Step Parameter Dialog:

Surface Consistent Statics

Surface Consistent Statics

Control Parameters

Number of iterations

Maximum allowable static (ms)

Analysis window length (ms)

Analysis start time (ms)

Maximum static offset

Iteration Convergence Value

☐ End iteration based on static value

Static value for exit (ms)

☒ Include residual NMO term

☒ Verbose console mode

Parameter Description:

Control Parameters

Number of iterations — Enter the number of iterations performed to calculate final source and receiver statics. The value must be greater than zero, and it is suggested that the value be no larger than 5.

Maximum allowable static (ms) — Enter the maximum allowable static shift in milliseconds. {>0}

Analysis window length (ms) — Enter the length of the analysis window. The trace data used for cross correlation with the pilot trace will extend from the start time to (start time + window length).

Analysis start time (ms) — Enter the start time for statics analysis.

Maximum static offset – Enter the largest offset used during analysis to generate source and receiver residual statics.

Iteration Convergence Value – The option exists end the Gauss-Seidel iterative scheme based on a maximum static supplied by the user.

End iteration based on static value — If checked, the Gauss-Seidel iterative scheme will end if maximum static computed in the previous iteration does not exceed a user-specified value.

Static value for exit (ms) – Enter the maximum static.

Include residual NMO term — If checked, a least squares linear fit will be removed from the final statics solution.

Verbose console mode — If checked, a least squares linear fit will be removed from the final statics solution.

Trim Statics

Usage:

Trim Statics calculates small CMP statics shifts for the data based on alignment of events within the specified window. You specify the start time and the length of the analysis window for calculation and the maximum allowed static shift. The step finds the static shift within these limits using automatic picking of the peak of the cross-correlation amplitude between the trace and the stacked trace for the gather.

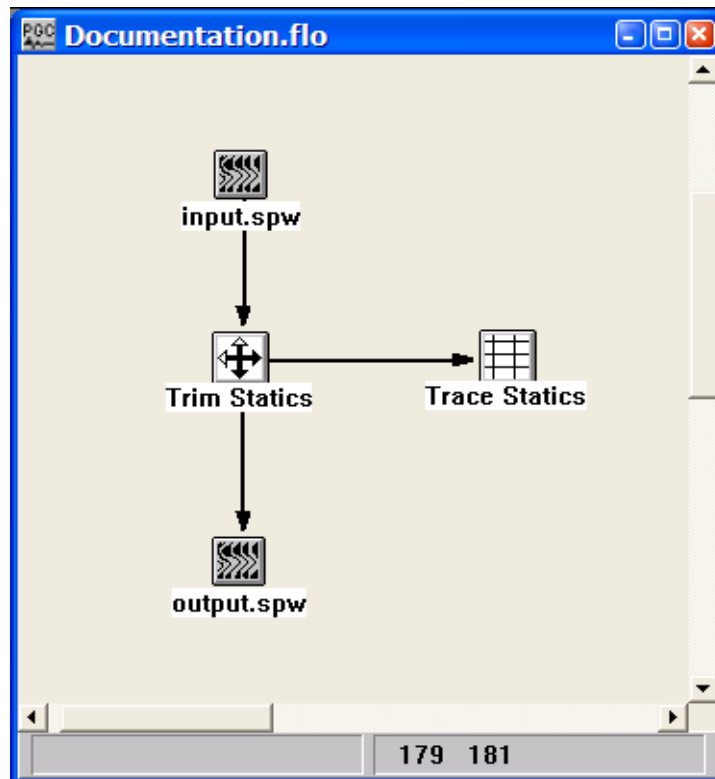
Input Links:

- 1) Seismic data in CMP sort order (mandatory).

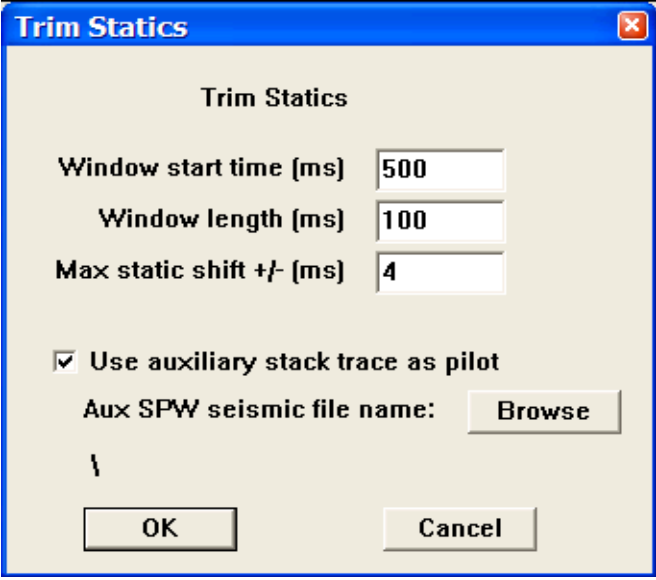
Output Links:

- 1) Seismic data in CMP sort order (mandatory).
- 2) Trace Statics (optional)

Example Flowchart:



Step Parameter Dialog:



The image shows a Windows-style dialog box titled "Trim Statics". It has a blue title bar with a close button (X) in the top right corner. The main area is light beige. At the top, the title "Trim Statics" is centered. Below it, there are three input fields with labels to their left: "Window start time (ms)" with the value "500", "Window length (ms)" with the value "100", and "Max static shift +/- (ms)" with the value "4". Below these fields is a checked checkbox labeled "Use auxiliary stack trace as pilot". Underneath the checkbox is a label "Aux SPW seismic file name:" followed by a text input field containing a backslash character "\" and a "Browse" button. At the bottom of the dialog are two buttons: "OK" and "Cancel".

Parameter Description:

Window start time (ms) — Enter the window start time in milliseconds for trim statics analysis.

Window length (ms) — Enter the length of the window in milliseconds for trim statics analysis.

Max static shift +/- (ms) — Enter the largest allowable static shift in milliseconds for trim statics analysis.

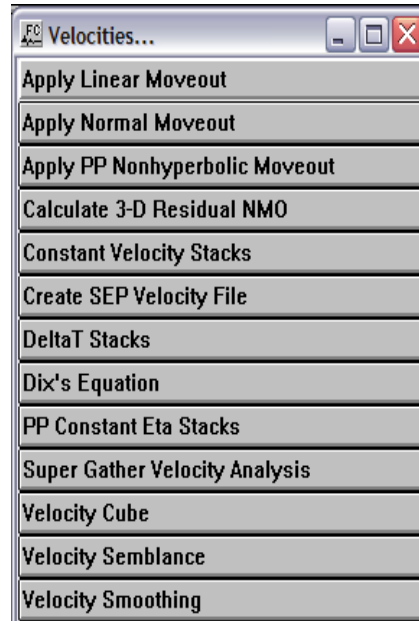
Use auxiliary stack trace as pilot – If checked, an auxiliary stack file may be selected and the stack traces in that file will serve as the trim static pilot traces.

Aux SPW seismic file name – Use the Browse button to select the auxiliary stack file.

Velocities

This section documents the processing steps available in the Velocity Steps category.

Processing steps currently available are:



Apply Linear Moveout

Usage:

The Apply Linear Moveout step allows you to apply a linear moveout function in either the forward or inverse direction. You specify the moveout velocity. You may also apply a constant static shift to your data. The moveout correction may be applied in a coarse or fine-grained application mode. A coarse grained static shift is applied to the nearest sample. Fine-grained static shifts are applied in the frequency domain by phase shifting your data.

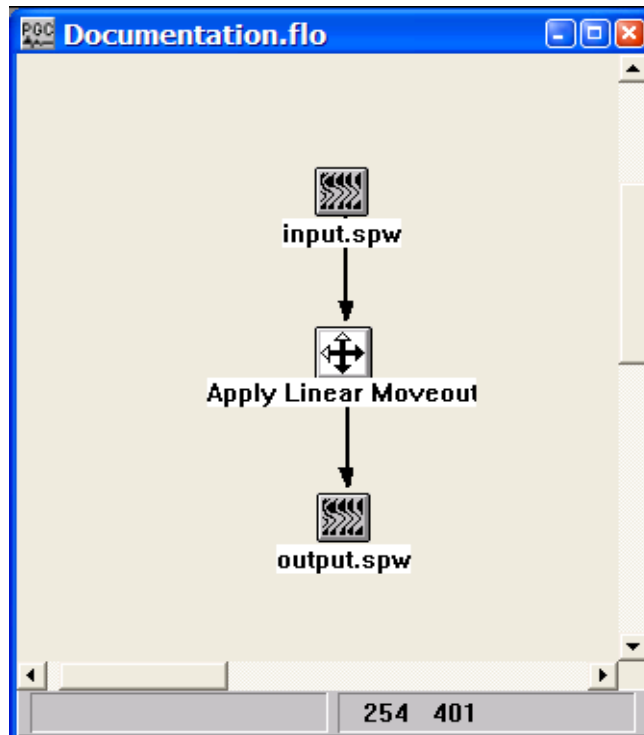
Input Links:

1) Seismic data in any sort order (mandatory).

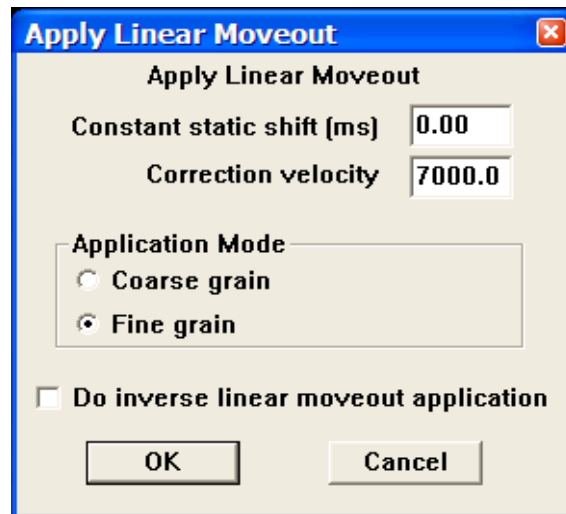
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Constant static shift (ms) — Enter a constant static shift in milliseconds.

Correction velocity — Enter the constant moveout velocity.

Static Application Mode — Select the statics application mode.

Coarse grain — This specifies the statics shifts will be applied to the nearest discrete sample position.

Fine grain — This specifies the statics shifts will be applied as a precise phase shift operator in the Fourier domain.

Do inverse linear moveout application — If checked, inverse linear moveout will be applied to your data.

Apply NMO

Usage:

The NMO Correction step allows you to apply normal moveout corrections to your pre-stack data using a single velocity or a set of velocity function cards. You choose between a linear or quadratic interpolation method for interpolating trace sample values back to even sample intervals after applying the moveout. You may also apply a stretch mute to your NMO corrected data. A constant velocity moveout may be accomplished by inputting a correction velocity in the dialog and not connecting any velocity function cards to the step. The NMO process automatically spatially interpolates the velocity over the entire range of CMPs in the line.

In the case of 3D data, the velocity functions are interpolated using a 2-D Delaunay triangulation weighting of evaluation points. Velocity function CMP locations are triangulated, then barycentric coordinates are used to compute weights between velocity functions. The interpolation is done laterally. No allowance is made for structure. An option allows for the application of a non-hyperbolic moveout correction.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Velocity Function cards (optional).

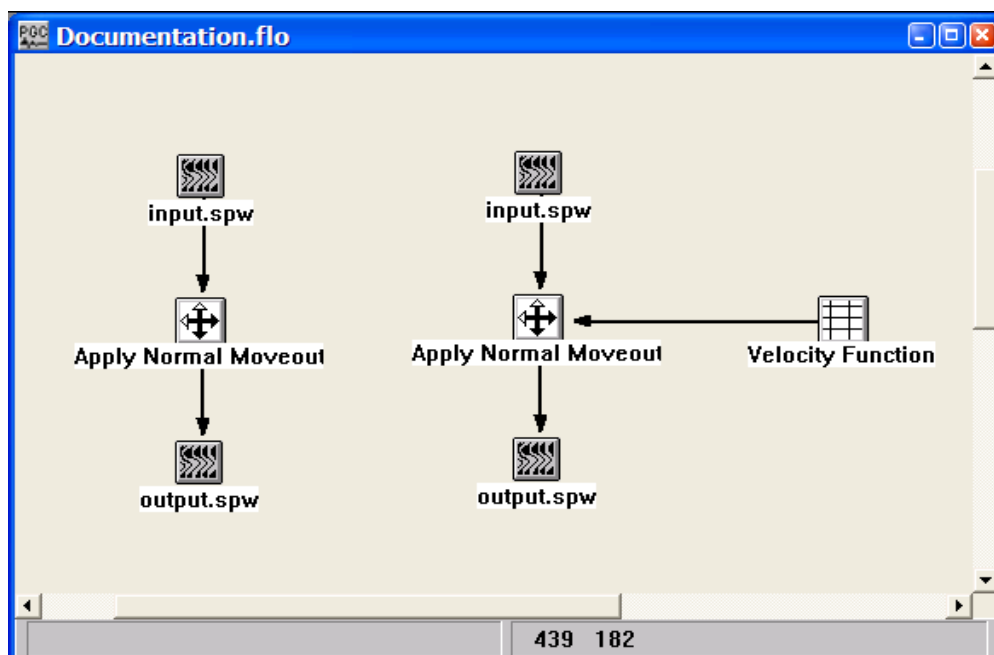
Output Links:

- 1) Seismic data in any sort order (mandatory).

References:

See Technical Note TN-NonHyperbolicMoveout.doc

Example Flowchart:



Step Parameter Dialog:

Apply Normal Moveout

Correction velocity: 7000.0

Interpolation Type Selection:
☐ Linear ☒ Quadratic

Scale input velocities by: 1.000

Mute Control:
☒ Apply stretch mute
Percentage: 30
Taper length [samples]: 15
☐ Do inverse NMO application

OK Cancel

Parameter Description:

Correction velocity — Enter the NMO velocity. This constant velocity that will be used if a set of velocity function cards is NOT linked to the NMO correction step.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Mute Control — Set the parameters for the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Scale input velocities by — Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Do inverse NMO application — If checked, the inverse NMO correction will be applied, instead of the usual forward NMO.

Apply PP Non-hyperbolic Moveout

Usage:

Non-hyperbolic P-wave moveout may become significant when source-receiver offsets are approximately equal to or greater than the depth of reflection. The resulting deviations from the hyperbolic traveltime equation may be attributed to one or more phenomena: (1) The standard hyperbolic travel-time equation is only a two-term, short-offset approximation of the full travel-time equation for P-wave reflections in layered media; (2) the earth media may be anisotropic. The Apply PP Non-hyperbolic Moveout step uses the travel-time equation for transversely isotropic (TI) media described by Alkhalifah and Tsvankin (1997). The resulting moveout is a function of the zero-offset time, the source-receiver offset, P-wave short-spread stacking velocity, and η (eta), where eta is an effective anisotropy parameter that measures the ratio of horizontal to vertical P-wave velocity. The Apply PP Non-hyperbolic Moveout step uses the combination of P-wave stacking velocities and Eta functions to correct for non-hyperbolic moveout.

Input Links:

- 4) Seismic data in any sort order (mandatory).
- 2) PP Nhmo Eta Function card containing eta pics (mandatory).

Output Links:

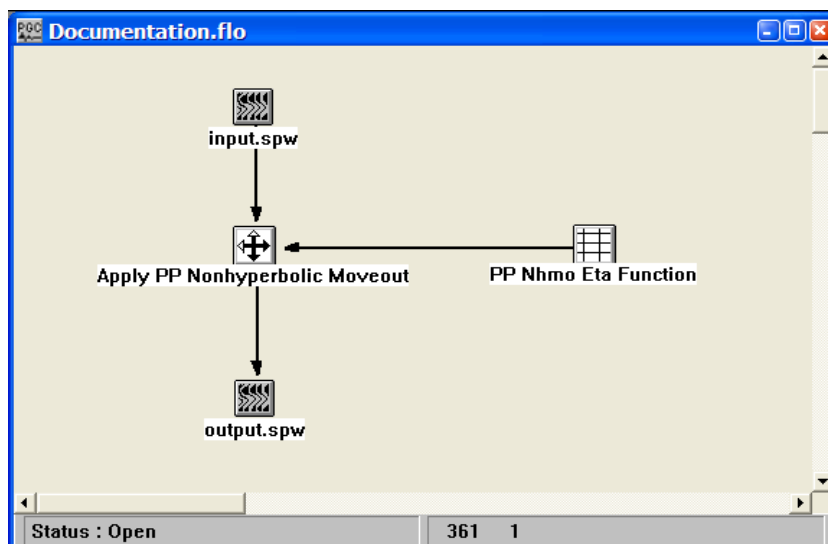
- 1) Seismic data in any sort order (mandatory).

Reference:

Alkhalifah, Tariq, 1997, Velocity analysis using nonhyperbolic moveout in transversely isotropic media: *Geophysics*, **62**, 1839-1854.

Alkhalifah, Tariq, and Tsvankin, Ilya, 1995, Velocity analysis for transversely isotropic media: *Geophysics*, **60**, 1550-1566.

Example Flowchart:



Step Parameter Dialog:

Apply PP Nonhyperbolic Moveout

Correction velocity: 1500.0

Interpolation Type Selection:
☐ Linear ☒ Quadratic

Mute Control:
☒ Apply stretch mute
Percentage: 30
Taper length (samples): 15

Scale input velocities by: 1.000 ☐ Do inverse moveout

Input PP velocity file:

Parameter Description:

Correction velocity — Enter the short-spread P-wave NMO velocity. This constant velocity will be used if a P-wave stacking velocity function is NOT selected with the Browse button.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Mute Control — Set the parameters for the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute tape length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Scale input velocities by – Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Do inverse NMO application — If checked, the inverse NMO correction will be applied, instead of the usual forward NMO.

Azimuth Velocity Analysis

Usage:

The Azimuth Velocity Analysis step creates azimuth restricted velocity semblance displays from the input CMP records. Azimuthal stacking velocities may be picked interactively from these semblance displays in SeisViewer. For semblance display generation, you designate the number of azimuth groups, the number of velocities, the starting velocity, and the velocity increment. The resulting output will contain one semblance panel for each user defined azimuth group (see figure below). An option exists to restrict the azimuthal semblance analysis to a time window of the input data.

Input Links:

1) Seismic data in CMP sort order (mandatory).

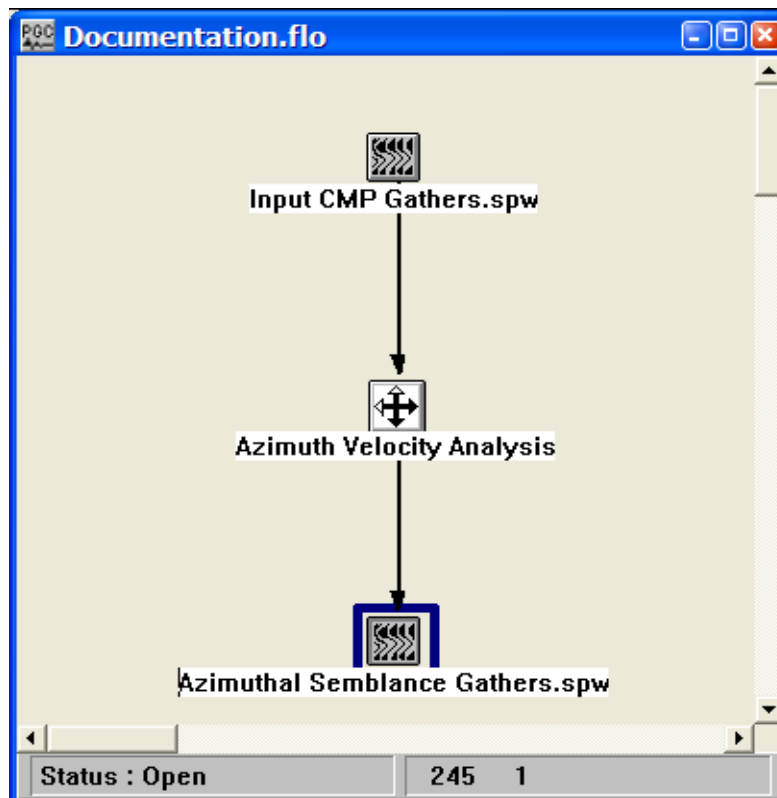
Output Links:

1) Seismic File (mandatory).

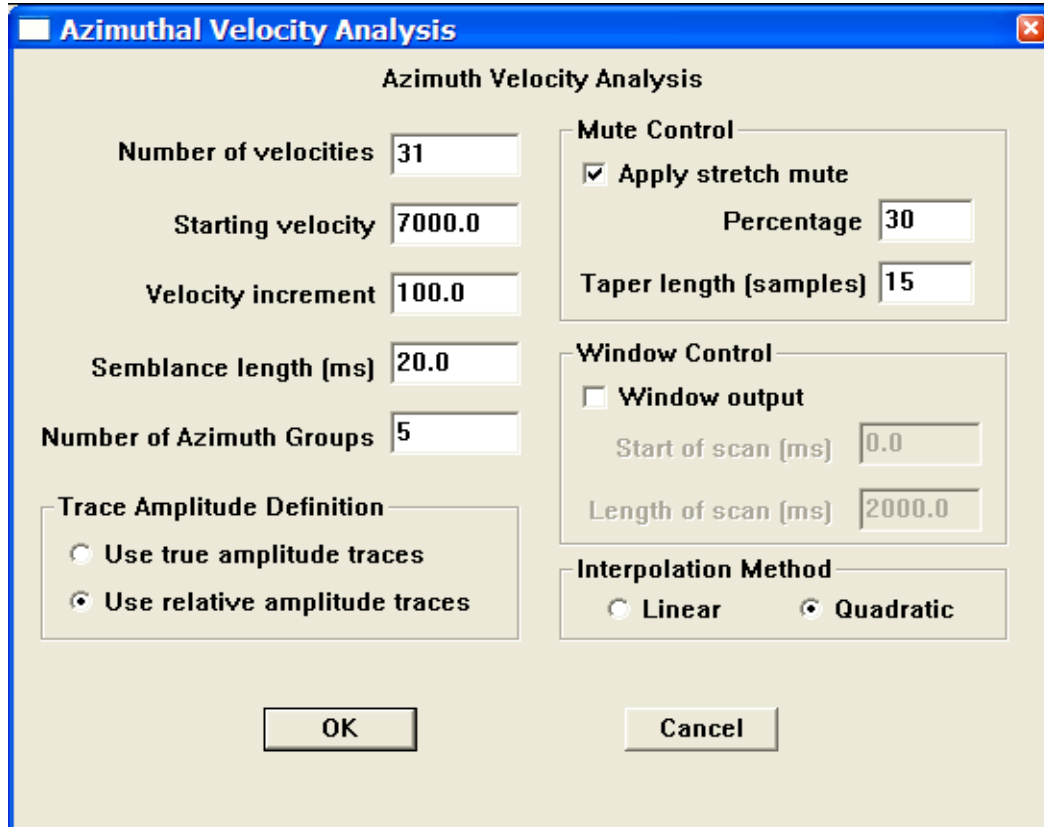
Reference:

Taner, M. and Kohler, 1969, Velocity spectra — digital computer derivation and applications of velocity functions, Geophysics, v. 34, no. 6, p. 859ff.

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Azimuthal Velocity Analysis" and contains several parameter groups:

- Number of velocities:** 31
- Starting velocity:** 7000.0
- Velocity increment:** 100.0
- Semblance length (ms):** 20.0
- Number of Azimuth Groups:** 5
- Trace Amplitude Definition:**
 - ☐ Use true amplitude traces
 - ☒ Use relative amplitude traces
- Mute Control:**
 - ☒ Apply stretch mute
 - Percentage:** 30
 - Taper length (samples):** 15
- Window Control:**
 - ☐ Window output
 - Start of scan (ms):** 0.0
 - Length of scan (ms):** 2000.0
- Interpolation Method:**
 - ☐ Linear
 - ☒ Quadratic

Buttons: OK, Cancel

Parameter Description:

Number of velocities — Enter the number of velocities to use in the analysis. A semblance value is calculated for each velocity linearly interpolated between the starting and ending input velocities.

Starting velocity — Enter the first velocity to scan.

Velocity increment — Enter the value by which the velocity is incremented.

Semblance length (ms) — Enter the length of the semblance calculation window in milliseconds.

Number of Azimuth Groups — Enter the number of azimuth groups to use in the analysis. The input CMP gathers sorted into source-receiver azimuth groups covering angles from 0 to 180 degrees. The first group will contain all source-receiver azimuths in the range 0 to $(180/\text{Number of Groups})$. The second group will contain all source-receiver azimuths in the range $(180/\text{Number of Groups})$ to $2 * (180/\text{Number of Groups})$, and so on (see figure below). At time increments of $(\text{Semblance Length}/2)$, a semblance value is calculated for each velocity linearly interpolated between the starting and ending input velocities.

Interpolation Method — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to even sampling at the correct interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Mute Control — Set the stretch mute control parameters.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction prior to one second.

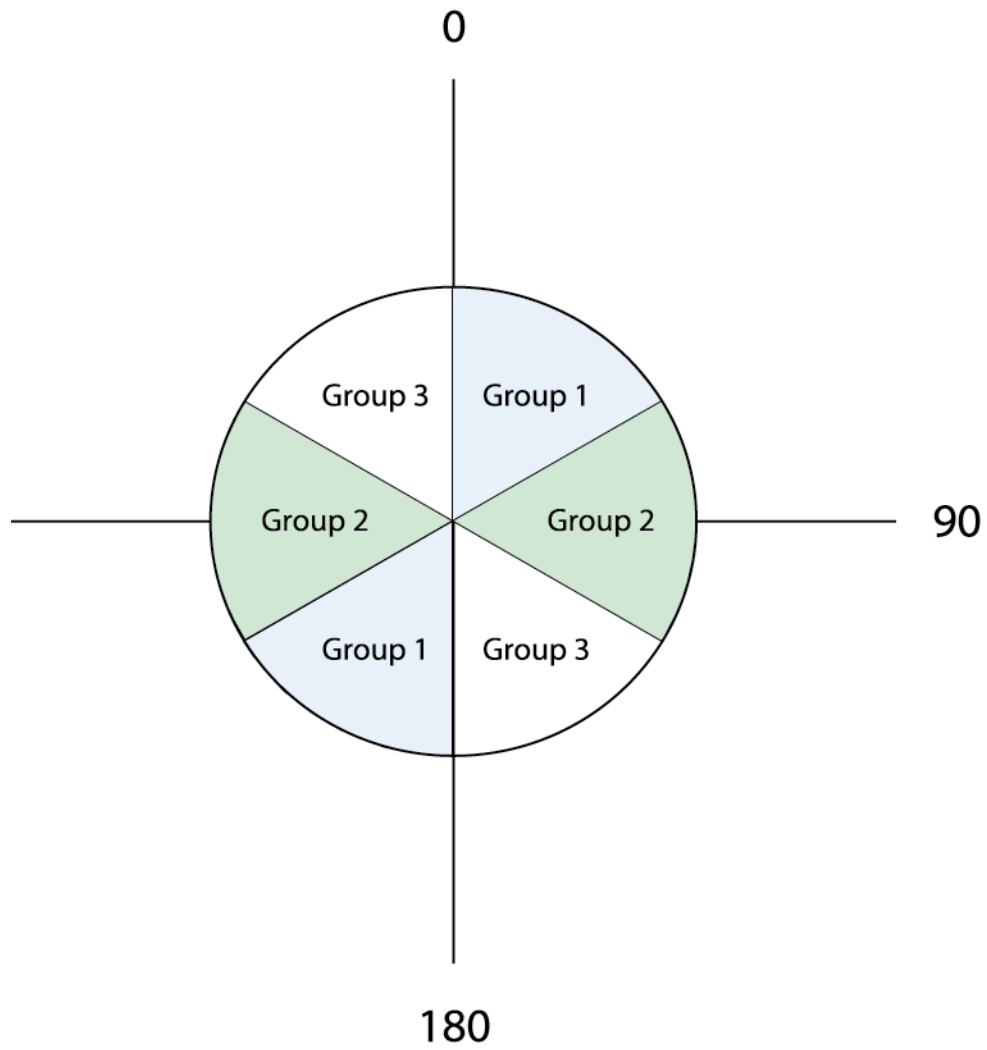
Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute tape length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Window Control — If checked, only a window of the scan will be output.

Start of scan (ms) — Enter the starting time of the semblance scan window.

Length of scan (ms) — Enter the scan window length.



Azimuth Velocity Analysis for the case of three azimuth groups: 0-60, 60-120, and 120-180.

Calculate 3-D Residual NMO

Usage:

Calculate residual NMO time shifts.

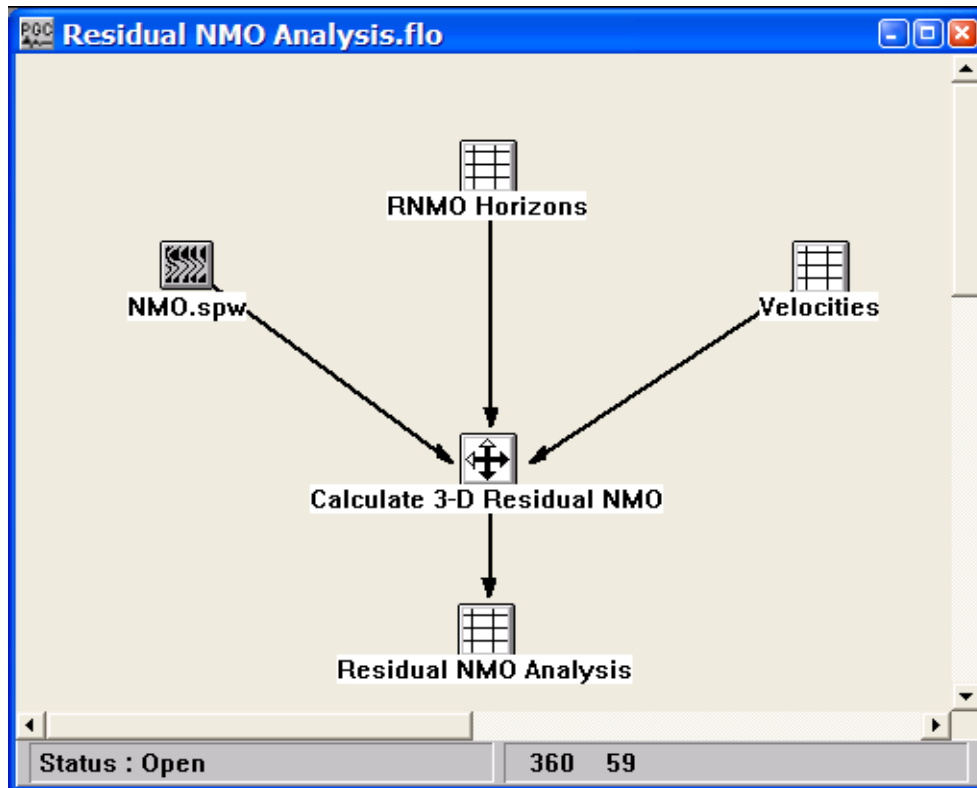
Input Links:

- 1) NMO corrected seismic data in bin sorted order (mandatory).
- 2) Horizon Pick cards (mandatory).
- 3) Velocity Function cards (optional).

Output Links:

- 1) Residual NMO Analysis card data (mandatory).

Example Flowchart:



Step Parameter Dialog:

Calculate 3-D Residual NMO

Correction velocity

Interpolation Type Selection

☐ Linear ☒ Quadratic

Mute Control

☒ Apply stretch mute

Percentage

Taper length [samples]

Smoothing Control

☐ Apply smoothing cube

Cube edge size (points)

Correlation window samples

Horizon number

OK Cancel

Parameter Description:

Correction velocity — Enter the NMO velocity. This is the constant velocity that will be used if a set of velocity function cards is NOT linked to the NMO correction step.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Mute Control — Set the parameters for the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute tape length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Correlation window samples — Length of the correlation window (in number of samples), centered on the horizon time, used in the computation of residual NMO time shifts.

Horizon number — Indicate the horizon number in the horizon file for which the residual NMO time shifts will be calculated.

Constant Velocity Stacks

Usage:

The Constant Velocity Analysis step generates a file of constant velocity stack traces. You choose the number of velocities with which to stack your data, the first velocity to apply, and the last velocity. You have the option to apply a stretch mute, if you so desire. With the series of constant velocity stack traces, you may page through these stacked panels in SeisViewer and interactively pick velocity functions that result in the most coherent stacked sections.

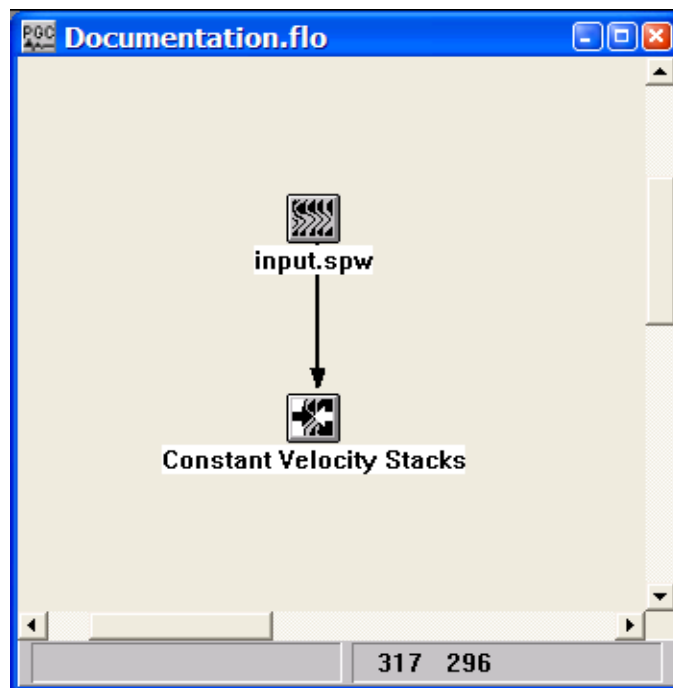
Input Links:

1) Seismic data pre-stack, in CMP sort order (mandatory),

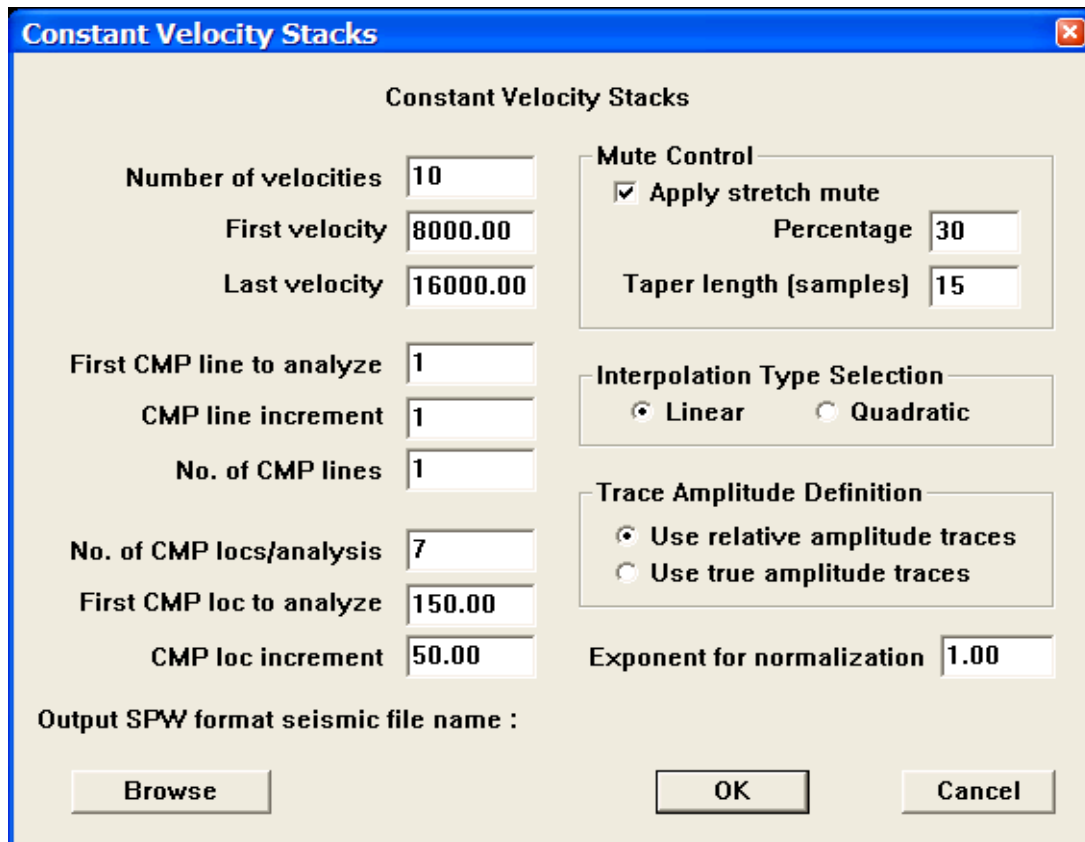
Output Links:

None - This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Constant Velocity Stacks" and contains the following fields and controls:

- Number of velocities:** 10
- First velocity:** 8000.00
- Last velocity:** 16000.00
- First CMP line to analyze:** 1
- CMP line increment:** 1
- No. of CMP lines:** 1
- No. of CMP locs/analysis:** 7
- First CMP loc to analyze:** 150.00
- CMP loc increment:** 50.00
- Mute Control:**
 - ☒ Apply stretch mute
 - Percentage:** 30
 - Taper length (samples):** 15
- Interpolation Type Selection:**
 - ☒ Linear
 - ☐ Quadratic
- Trace Amplitude Definition:**
 - ☒ Use relative amplitude traces
 - ☐ Use true amplitude traces
- Exponent for normalization:** 1.00
- Output SPW format seismic file name :**
-

Parameter Description:

Number of velocities — Enter the number of velocities to use in the analysis. A stacked section is calculated for each velocity linearly interpolated between the starting and ending input velocities. The velocity increment will be:

$$V_{inc} = (\text{last velocity} - \text{first velocity}) / (\text{Number of velocities} - 1).$$

First velocity — Enter the starting velocity for the analysis. This velocity will be used for NMO on the first output stack. {>0.0}

Last velocity — Enter the ending velocity for the analysis. This velocity will be used for NMO on the last output stack. {>0.0}

First CMP line to analyze — Enter the first CMP line number to analyze.

CMP line increment — Enter the CMP line increment between lines to analyze.

No. of CMP lines — Enter the number of CMP lines to analyze.

No. of CMP locs/analysis — Enter the number of CMP locations in each analysis panel. At each CMP location a range of constant velocity stacks will be generated from the first velocity to the last velocity in increments of V_{inc}

First CMP loc to analyze — Enter the first CMP location to analyze.

CMP loc increment — Enter the CMP location increment between groups of CMP locations to analyze.

Mute Control — Select the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace Amplitude Definition — Select the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Browse — Select an existing SPW format seismic file or enter the name of a new SPW format seismic file to use for output from the process.

Delta-T Stacks

Usage:

The Delta-T Stacks step generates a series of constant delta-T stack traces. The delta-T is measured from a user supplied reference velocity field. As such, the Delta-T Stacks step is designed to refine previously picked velocity fields. You choose the number first delta-T stack, the last delta-T stack, and the number of delta-T stacks to generate. You have the option to apply a stretch mute to the NMO corrected data, if you so desire. With the series of constant delta-T stack traces, you may page through these stacked panels in SeisViewer and interactively pick velocity functions that result in the most coherent stacked sections.

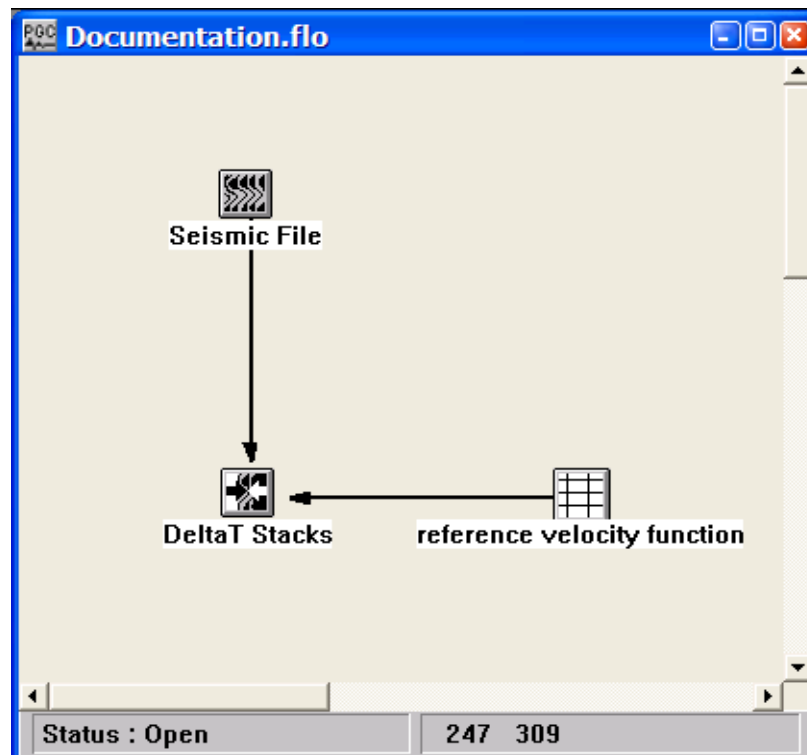
Input Links:

- 1) Seismic data pre-stack, in CMP sort order (mandatory),

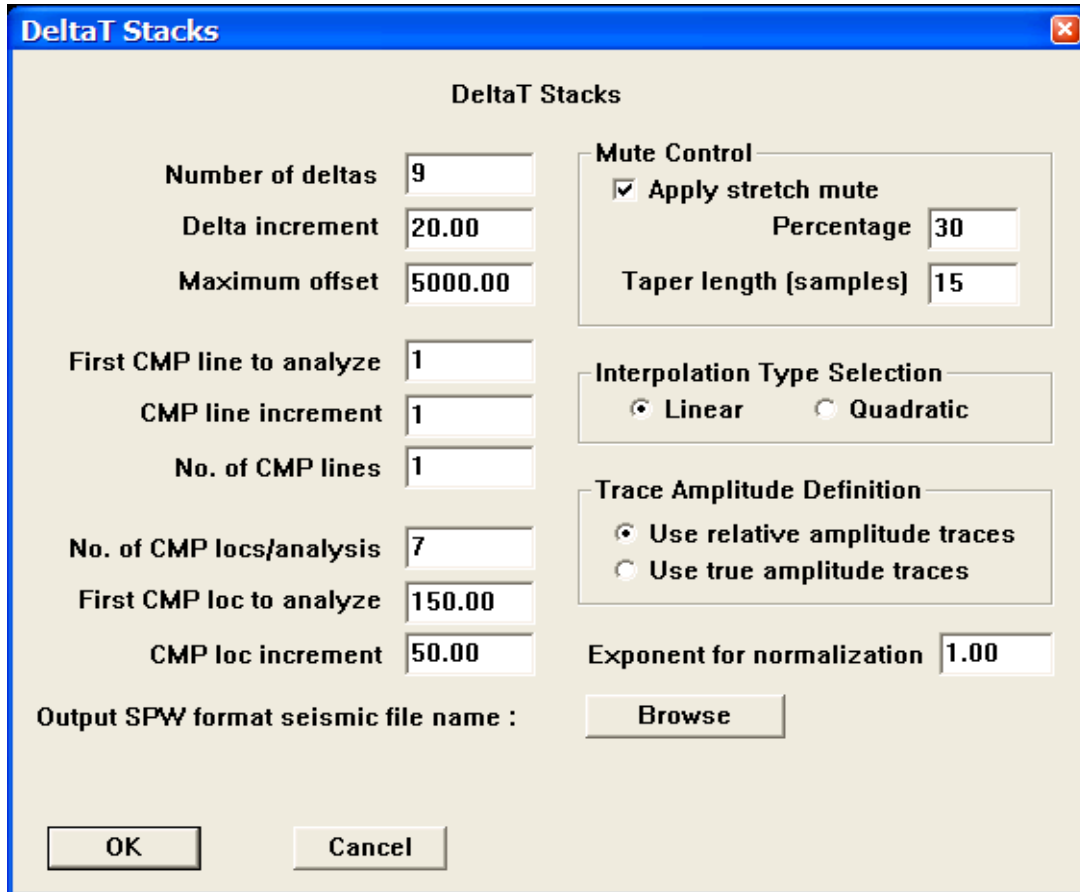
Output Links:

None - This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "DeltaT Stacks". It contains several input fields and control groups. On the left, there are fields for "Number of deltas" (9), "Delta increment" (20.00), "Maximum offset" (5000.00), "First CMP line to analyze" (1), "CMP line increment" (1), "No. of CMP lines" (1), "No. of CMP locs/analysis" (7), "First CMP loc to analyze" (150.00), and "CMP loc increment" (50.00). On the right, there are three grouped sections: "Mute Control" with a checked "Apply stretch mute" and "Percentage" (30), and "Taper length [samples]" (15); "Interpolation Type Selection" with radio buttons for "Linear" (selected) and "Quadratic"; and "Trace Amplitude Definition" with radio buttons for "Use relative amplitude traces" (selected) and "Use true amplitude traces". Below these is an "Exponent for normalization" field set to 1.00. At the bottom left is a label "Output SPW format seismic file name :" followed by a "Browse" button. At the very bottom are "OK" and "Cancel" buttons.

DeltaT Stacks	
Number of deltas	9
Delta increment	20.00
Maximum offset	5000.00
First CMP line to analyze	1
CMP line increment	1
No. of CMP lines	1
No. of CMP locs/analysis	7
First CMP loc to analyze	150.00
CMP loc increment	50.00
Output SPW format seismic file name : Browse	
OK Cancel	

Parameter Description:

Number of deltas — Enter the number of deltas to use in the analysis. A stacked section is calculated for each delta between the starting and ending d eltas.

Delta increment — Enter the delta increment for the analysis. This velocity will be used for NMO on the first output stack. {>0.0}

Maximum offset — Enter the ending velocity for the analysis. This velocity will be used for NMO on the last output stack. {>0.0}

First CMP line to analyze — Enter the first CMP line number to analyze.

CMP line increment — Enter the CMP line increment between lines to analyze.

No. of CMP lines — Enter the number of CMP lines to analyze.

No. of CMP locs/analysis — Enter the number of CMP locations in each analysis panel.

First CMP loc to analyze — Enter the first CMP location to analyze.

CMP loc increment — Enter the CMP location increment between groups of CMP locations to analyze.

Mute Control — Select the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO .

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function. A value of zero will mute everything prior to one second.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

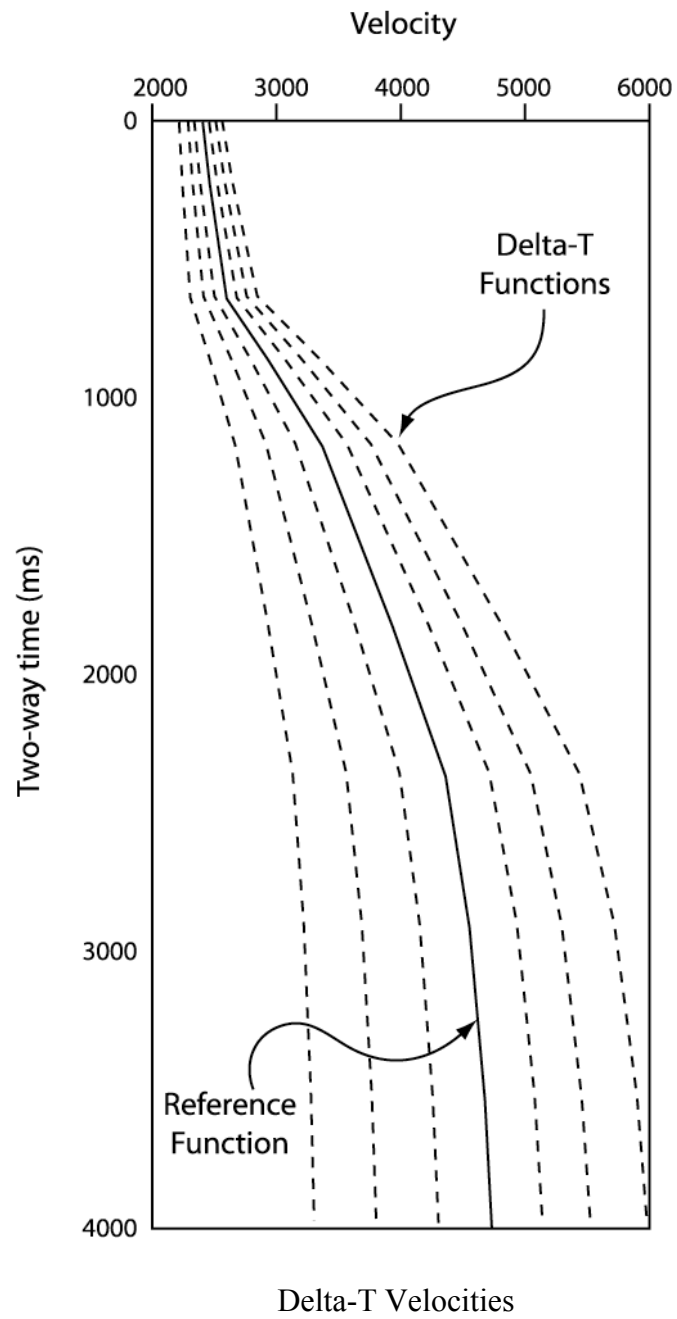
Trace Amplitude Definition — Select the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Browse — Select an existing SPW format seismic file or enter the name of a new SPW format seismic file to use for output from the process.



Dix's Equation

Usage:

The Dix's Equation step will convert a set of RMS velocity function cards to interval velocity cards. The interval velocity cards are suitable for input into a migration process.

Input Links:

1) Velocity Function cards containing RMS stacking velocities (mandatory).

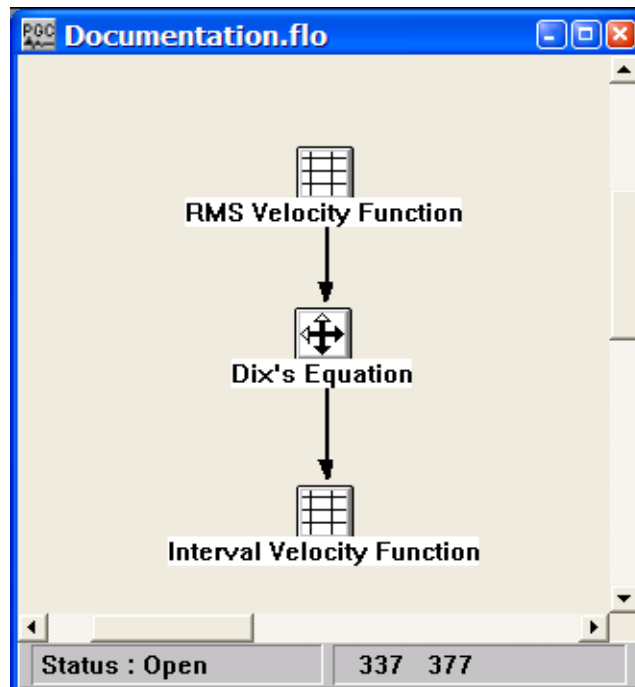
Output Links:

1) Velocity Function cards containing interval velocities (mandatory).

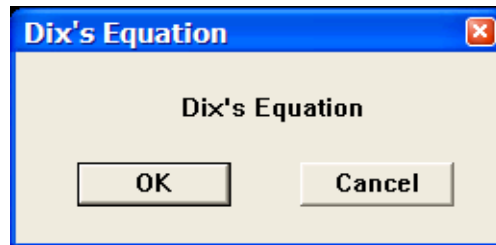
Reference:

Dix, C.H., 1955, Seismic velocities from surface measurements, Geophysics vol. 20, no. 1, p. 68ff.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

PP Constant Eta Stacks

Usage:

The PP Constant Eta Stacks step generates a file of constant eta stack traces, where eta is defined as $0.5 (V_h^2 / V_{nmo}^2 - 1)$. A P-wave stacking velocity field must be supplied, and you choose the number of eta with which to stack your data, the first eta to apply, and the last eta to apply. You have the option to apply a stretch mute, if you so desire. With the series of constant eta stack traces, you page through these stacked panels in SeisViewer and interactively pick eta functions that result in the most coherent stacked sections.

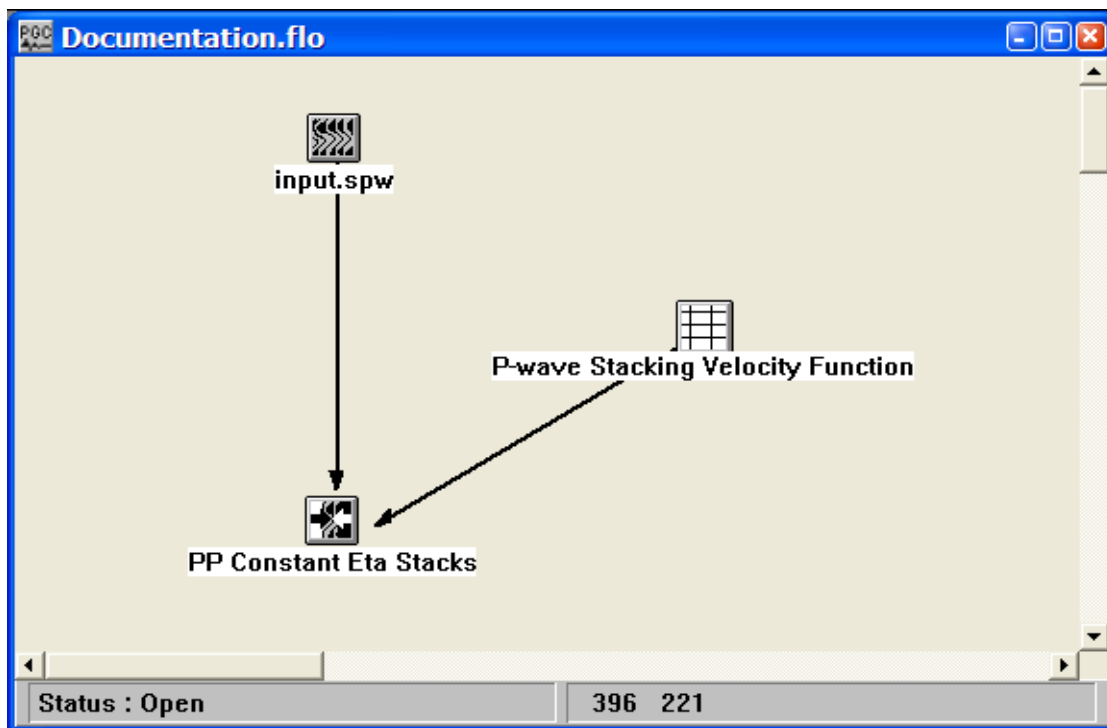
Input Links:

- 1) Seismic data pre-stack, in CMP sort order (mandatory).
- 2) Velocity card data file containing p-wave stacking velocity functions (mandatory).

Output Links:

None - This process writes directly to an output disk file.

Example Flowchart:



Step Parameter Dialog:

PP Constant Eta Stack

Number of etas: 20
First eta: -1.00
Last eta: 1.00

First CMP line to analyze: 1
CMP line increment: 1
No. of CMP lines: 1

No. of CMP locs/analysis: 7
First CMP loc to analyze: 150.00
CMP loc increment: 50.00

Mute Control
☒ Apply stretch mute
Percentage: 30
Taper length (samples): 15

Interpolation Type Selection
☒ Linear ☐ Quadratic

Trace Amplitude Definition
☒ Use relative amplitude traces
☐ Use true amplitude traces

Exponent for normalization: 1.00

Output SPW format seismic file name :
Browse

OK Cancel

Parameter Description:

Number of etas — Enter the number of gammas to use in the analysis. A stacked section is calculated for each eta linearly interpolated between the starting and ending input gamma. The eta increment will be:

$$\text{Eta}_{\text{inc}} = (\text{last eta} - \text{first eta}) / (\text{Number of eta} - 1).$$

First eta — Enter the starting eta for the analysis. This eta will be used for non-hyperbolic NMO on the first output stack. {>0.0}

Last eta — Enter the ending eta for the analysis. This eta will be used for non-hyperbolic NMO on the last output stack. {>0.0}

First CMP line to analyze — Enter the first CMP line number to analyze.

CMP line increment — Enter the CMP line increment between lines to analyze.

No. of CMP lines — Enter the number of CMP lines to analyze.

No. of CMP locs/analysis — Enter the number of CMP locations in each analysis panel. At each CMP location a range of constant velocity stacks will be generated from the first velocity to the last velocity in increments of V_{inc}

First CMP loc to analyze — Enter the first CMP location to analyze.

CMP loc increment — Enter the CMP location increment between groups of CMP locations to analyze.

Mute Control — Select the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace Amplitude Definition — Select the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Browse — Select an existing SPW format seismic file or enter the name of a new SPW format seismic file to use for output from the process.

Supergather Velocity Analysis

Usage:

The PP Constant Eta Stacks step generates a file of constant eta stack traces, where eta is defined as $0.5 (V_h^2 / V_{nmo}^2 - 1)$. A P-wave stacking velocity field must be supplied, and you choose the number of eta with which to stack your data, the first eta to apply, and the last eta to apply

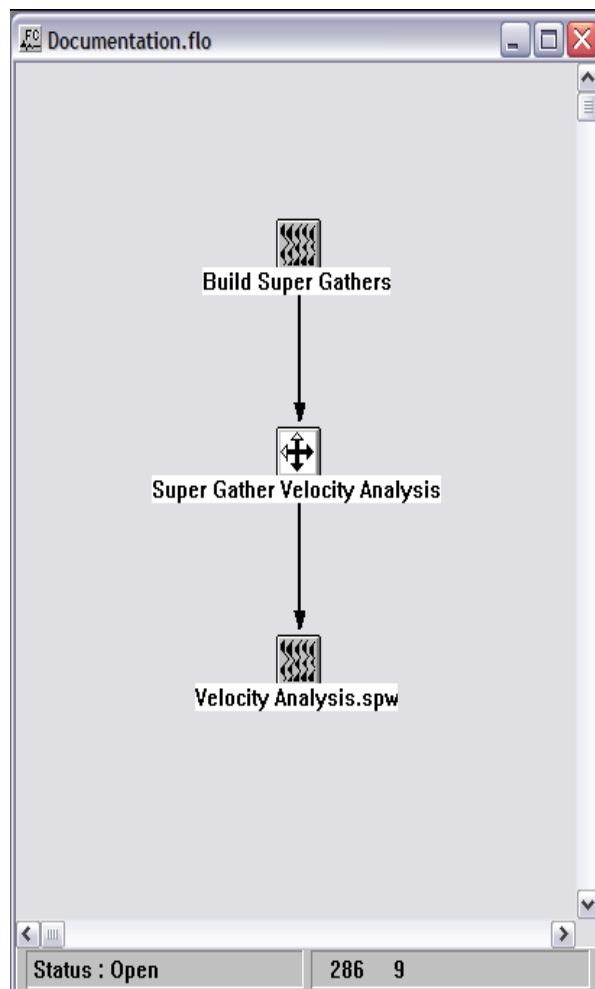
Input Links:

- 1) Seismic data output from the Build Super Gathers processing step (mandatory).

Output Links:

- 1) Seismic File (mandatory).

Example Flowchart:



Step Parameter Dialog:

Super Gather Velocity Analysis

Super Gather Velocity Analysis

Number of velocities

Starting velocity

Velocity increment

Semblance length (ms)

Offset bin size

Semblance interval (ms)

Mute Control

☒ Apply stretch mute

Percentage

Taper length (samples)

Trace Amplitude Definition

☐ Use true amplitude traces

☒ Use relative amplitude traces

Interpolation Method

☐ Linear ☒ Quadratic

☒ Output CVS mini-stacks

C:\spw\Example CVS Stacks.spw

☒ Output binned gathers

C:\spw\Example Supergathers.spw

CVS Browse...

Gather Browse...

OK Cancel

Parameter Description:

Number of velocities — Enter the number of velocities to use in the analysis. A stacked section is calculated at each velocity increment from Starting velocity to Starting Velocity + Velocity increment * (Number of velocities-1).

Starting velocity — First velocity to scan.

Velocity increment — Increment of velocity scans.

Semblance length (ms) — Length over which semblance is calculated.

Offset bin size —

Semblance interval — Time increment for calculating semblance.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace Amplitude Definition — Select the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

CVS Browse — Assign a file name to the output CVS panels.

Gather Browse — Assign a file name to the output supergathers.

Velocity Cube

Usage:

The Velocity Cube step inputs a 3D seismic volume, the corresponding stacking velocity cards, and outputs a velocity cube with a velocity function defined at each bin position.

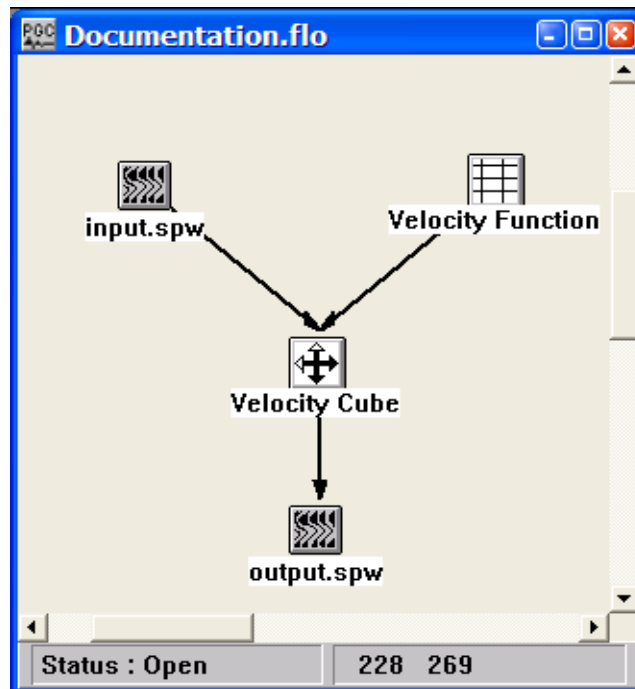
Input Links:

- 1) Seismic data in CMP sort order (mandatory).
- 2) Velocity Function card (mandatory).

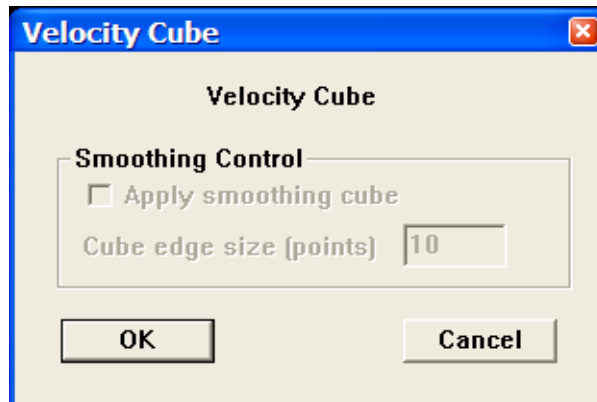
Output Links:

- 1) Seismic File (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Smoothing Control — The smoothing options are not active.

Velocity Semblance

Usage:

The Velocity Semblance step creates velocity semblance displays for the input CMP records. Stacking velocities may be picked interactively from this semblance display in SeisViewer. For semblance display generation, you designate the velocity range for semblance calculation by choosing the number of velocities, the starting velocity for this range, and the velocity increment. You may generate only one CMP semblance display for each input CMP gather. You may also control the time gate length around hyperbolic velocity paths for CMP summing in the semblance calculation using the “Semblance length” input parameter. Finally, the output semblance display may be windowed, and a stretch mute may be applied if so desired.

Input Links:

- 1) Seismic data in CMP sort order (mandatory).

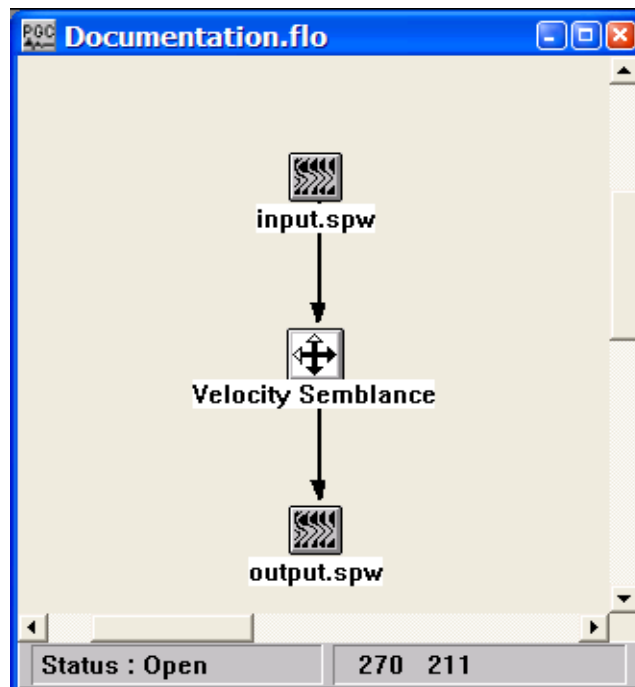
Output Links:

- 1) Seismic File (mandatory).

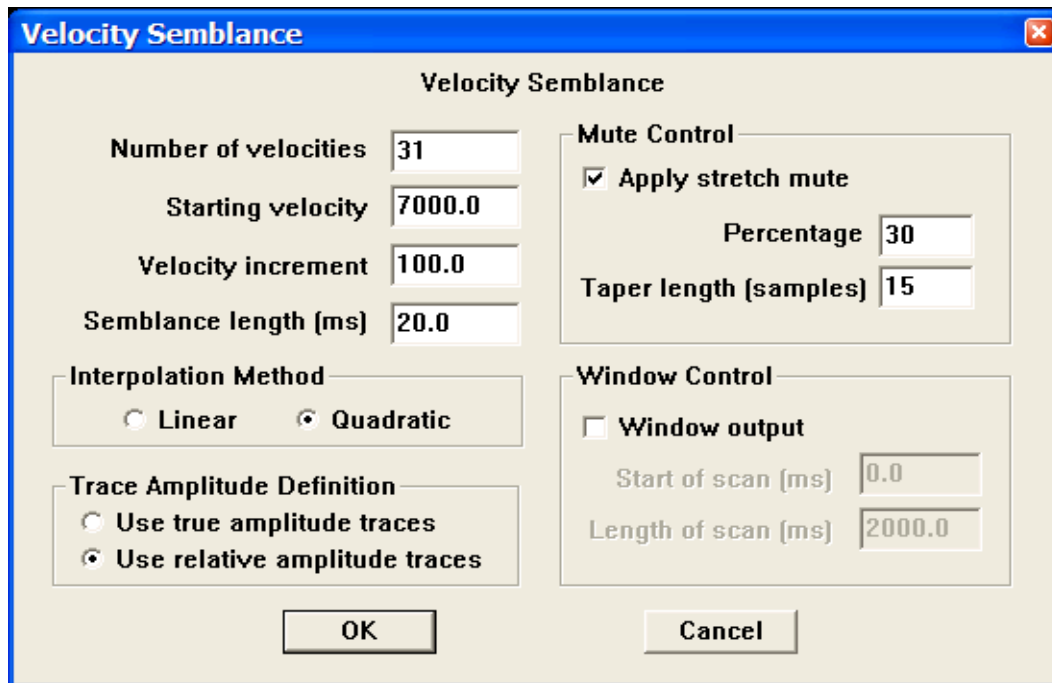
Reference:

Taner, M. and Kohler, 1969, Velocity spectra — digital computer derivation and applications of velocity functions, Geophysics, v. 34, no. 6, p. 859ff.

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Velocity Semblance". It contains several input fields and checkboxes. On the left, there are four input fields: "Number of velocities" (31), "Starting velocity" (7000.0), "Velocity increment" (100.0), and "Semblance length (ms)" (20.0). Below these are two radio button options for "Interpolation Method": "Linear" and "Quadratic", with "Quadratic" selected. Underneath is another set of radio buttons for "Trace Amplitude Definition": "Use true amplitude traces" and "Use relative amplitude traces", with the latter selected. On the right side, there is a "Mute Control" section with a checked checkbox "Apply stretch mute", a "Percentage" input field (30), and a "Taper length (samples)" input field (15). Below that is a "Window Control" section with an unchecked checkbox "Window output", a "Start of scan (ms)" input field (0.0), and a "Length of scan (ms)" input field (2000.0). At the bottom are "OK" and "Cancel" buttons.

Velocity Semblance	
Number of velocities	31
Starting velocity	7000.0
Velocity increment	100.0
Semblance length (ms)	20.0
Interpolation Method	
<input type="radio"/> Linear	<input checked="" type="radio"/> Quadratic
Trace Amplitude Definition	
<input type="radio"/> Use true amplitude traces	<input checked="" type="radio"/> Use relative amplitude traces
Mute Control	
<input checked="" type="checkbox"/> Apply stretch mute	
Percentage	30
Taper length (samples)	15
Window Control	
<input type="checkbox"/> Window output	
Start of scan (ms)	0.0
Length of scan (ms)	2000.0
OK Cancel	

Parameter Description:

Number of velocities — Enter the number of velocities to use in the analysis. At time increments of (Semblance Length/2), a semblance value is calculated for each velocity linearly interpolated between the starting and ending input velocities.

Starting velocity — Enter the first velocity to scan.

Velocity increment — Enter the value by which the velocity is incremented.

Semblance length (ms) — Enter the length of the semblance calculation window in milliseconds.

Interpolation Method — Select the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to even sampling at the correct interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Trace Amplitude Definition — Amplitude summing selection.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Mute Control — Set the stretch mute control parameters.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction prior to one second.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Window Control — If checked, only a window of the scan will be output.

Start of scan (ms) — Enter the starting time of the semblance scan window.

Length of scan (ms) — Enter the scan window length.

Velocity Smoothing

Usage:

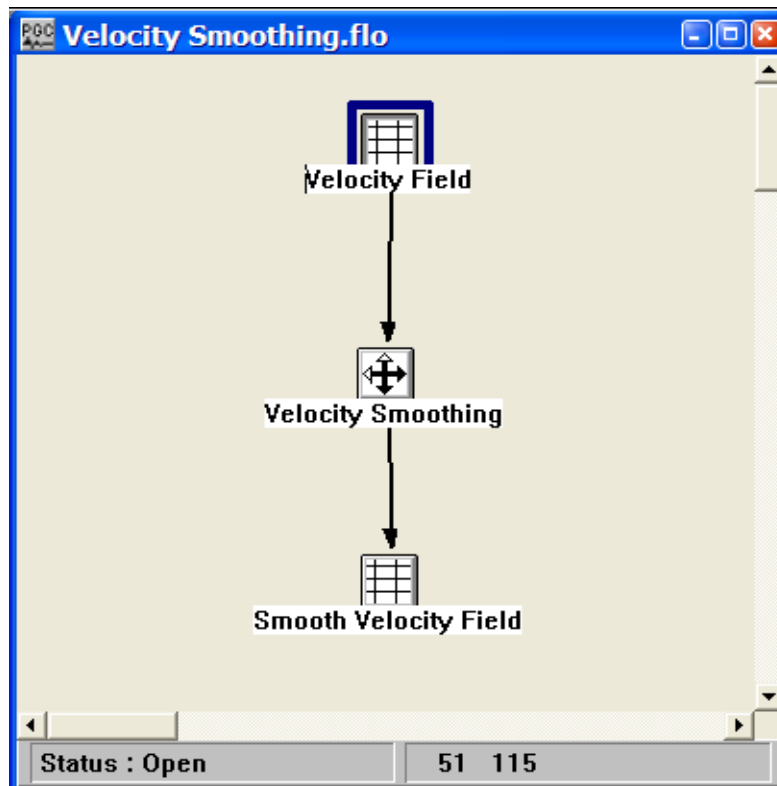
The Velocity Smoothing step generates a smoothed version of a velocity field.

Input Links:

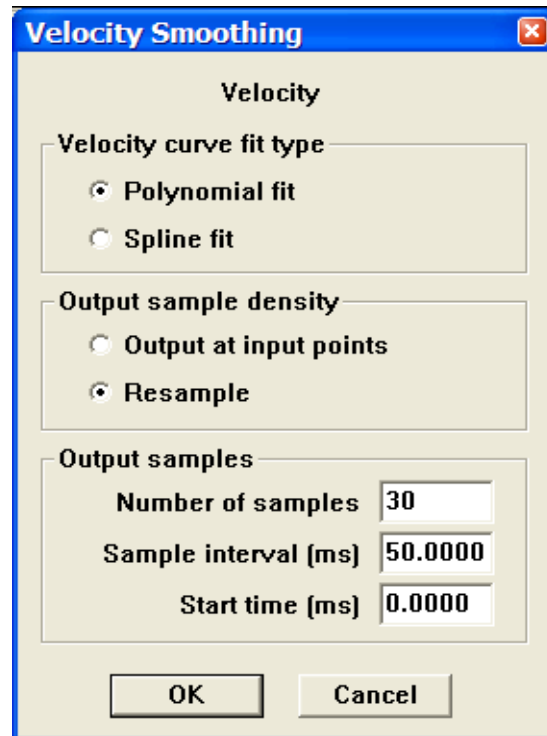
- 2) Velocity Function card file (mandatory).

Output Links:

- 1) Velocity Function card file (mandatory).

Example Flowchart:

Step Parameter Dialog:



The image shows a 'Velocity Smoothing' dialog box with a blue title bar and a close button. It contains three main sections: 'Velocity curve fit type' with radio buttons for 'Polynomial fit' (selected) and 'Spline fit'; 'Output sample density' with radio buttons for 'Output at input points' and 'Resample' (selected); and 'Output samples' with input fields for 'Number of samples' (30), 'Sample interval (ms)' (50.0000), and 'Start time (ms)' (0.0000). At the bottom are 'OK' and 'Cancel' buttons.

Parameter Description:

Velocity curve fit type —

Polynomial fit —

Spline —

Output sample density —

Output at input points — The time-velocity pairs in the smoothed output velocity function will be located at the same times present in the input velocity function.

Resample — The time of the time-velocity pairs will be specified by the user.

Output samples — If the output samples are being resampled, select the sampling interval.

Number of samples — Enter the number of time-velocity pairs in each output velocity function.

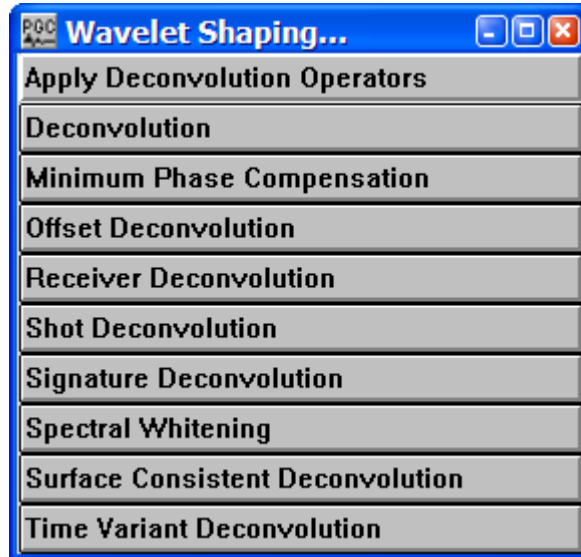
Sample interval (ms) — Enter the interval – in ms – between each time-velocity pair.

Start time (ms) — Enter the time of the first time-velocity pair.

Wavelet Shaping Steps

This section documents the processing steps available in the Wavelet Shaping Steps category.

Processing steps currently available are:



Apply Deconvolution Operators

Usage:

The Apply Deconvolution Operators step is used to apply deconvolution operators output by either the Deconvolution step or the Surface Consistent Deconvolution step. In each case the file of operators is a SPW formatted seismic data file.

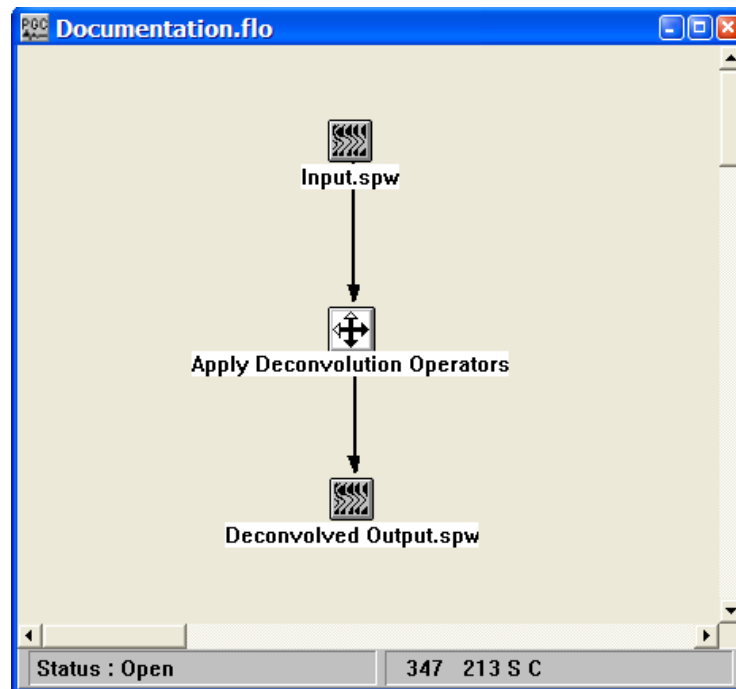
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Auxiliary data file containing the operators to be applied (mandatory).

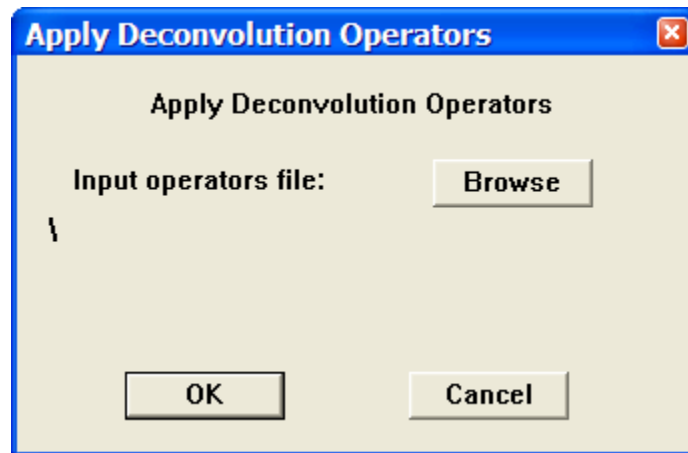
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input operators file — Use the Browse button to locate the SPW formatted file of deconvolution operators that will be applied to the input data.

Deconvolution

Usage:

The Deconvolution step is a Wiener-Levinson algorithm for applying either spiking or predictive deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of the first operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset. An option exists to output the computed deconvolution operators for subsequent use with the Apply Deconvolution Operators step.

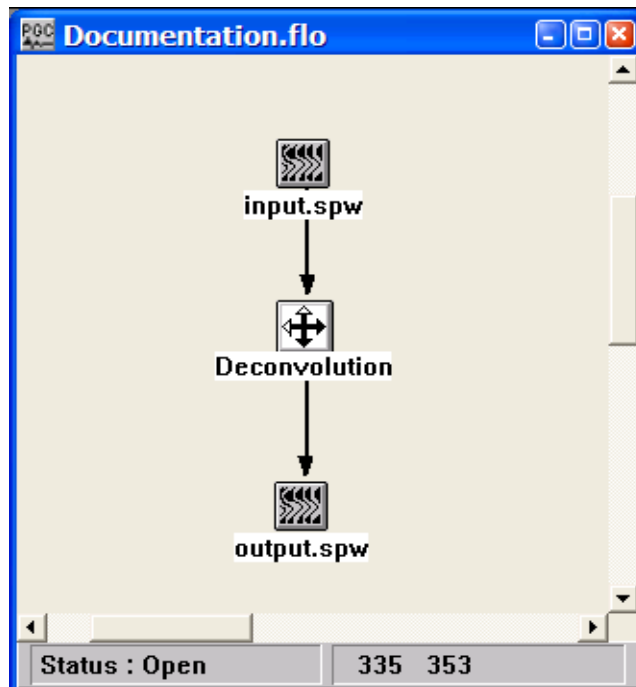
Input Links:

- 3) Seismic data in any sort order (mandatory).
- 4) Horizon card data containing water bottom time picks (optional).

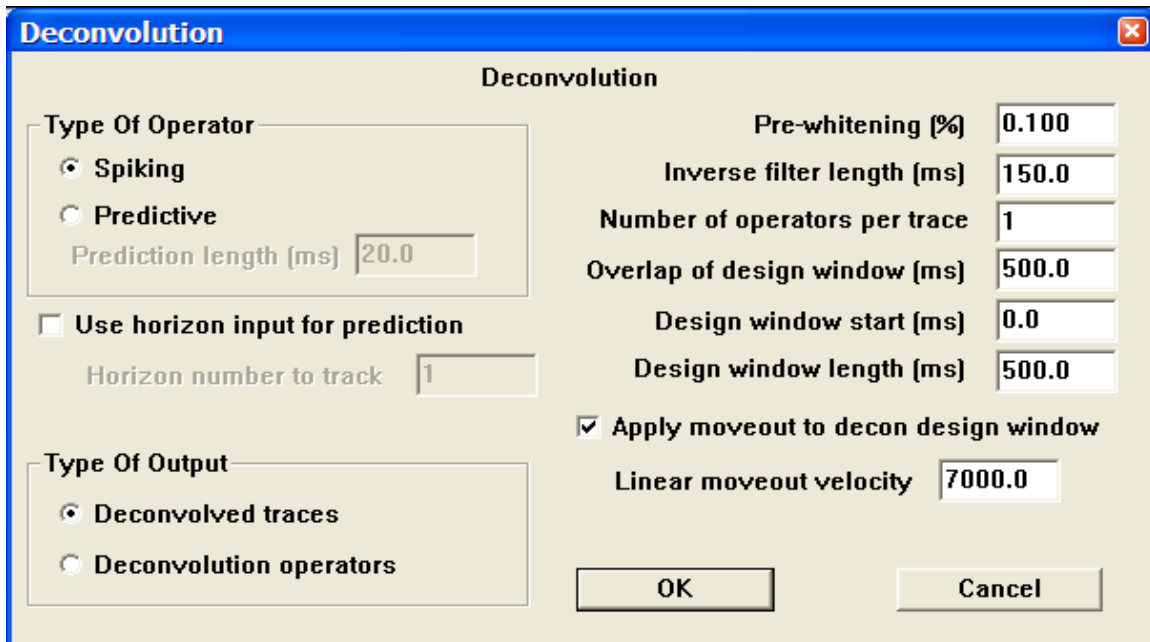
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Deconvolution". It contains several sections for configuring deconvolution parameters. On the left, there are two main sections: "Type Of Operator" and "Type Of Output". The "Type Of Operator" section has two radio buttons: "Spiking" (selected) and "Predictive". Below "Predictive" is a text field for "Prediction length (ms)" with the value "20.0". There is also a checkbox for "Use horizon input for prediction" which is currently unchecked, and a text field for "Horizon number to track" with the value "1". The "Type Of Output" section has two radio buttons: "Deconvolved traces" (selected) and "Deconvolution operators". On the right side of the dialog, there are several numerical input fields: "Pre-whitening (%)" with "0.100", "Inverse filter length (ms)" with "150.0", "Number of operators per trace" with "1", "Overlap of design window (ms)" with "500.0", "Design window start (ms)" with "0.0", and "Design window length (ms)" with "500.0". There is also a checked checkbox for "Apply moveout to decon design window" and a text field for "Linear moveout velocity" with "7000.0". At the bottom right, there are "OK" and "Cancel" buttons.

Parameter	Value
Type Of Operator	Spiking
Prediction length (ms)	20.0
Use horizon input for prediction	False
Horizon number to track	1
Type Of Output	Deconvolved traces
Pre-whitening (%)	0.100
Inverse filter length (ms)	150.0
Number of operators per trace	1
Overlap of design window (ms)	500.0
Design window start (ms)	0.0
Design window length (ms)	500.0
Apply moveout to decon design window	True
Linear moveout velocity	7000.0

Parameter Description:

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Weiner-Levinson spiking deconvolution.

Predictive — Weiner-Levinson predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Use horizon input for prediction – If checked, allows the input of times (e.g. water bottom) from a Horizon card data file to establish the prediction distance on a record- by-record basis.

Horizon number to track – Enter the horizon number in the Horizon card data file that will by used to establish the prediction distance.

Type of Output — By default, the Devonvolution step outputs deconvolved traces. However, the option exists to output the computed deconvolution operators for subsequent use with the Apply Deconvolution Operators step.

Deconvolved traces — Output deconvolved traces.

Deconvolution operators — Output deconvolution operators.

Pre-whitening percent — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the inverse filter to be calculated and applied in milliseconds.

Number of operators per trace — Enter the number of separate deconvolution inverse filters to calculate per trace. If more than one, then the trace is divided into this number of windows and each window has an inverse filter individually calculated and applied.

Overlap of design window (ms) — Enter the overlap in milliseconds of the trace windows. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

Design window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Design window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Apply moveout to decon design window — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Minimum Phase Compensation

Usage:

Minimum Phase Compensation allows you to compensate for the non-minimum phase nature of some seismic sources, such as Vibroseis™. The step calculates the minimum phase equivalent of a supplied source signature trace and then filters the data with a filter which converts the supplied signature to its minimum phase equivalent.

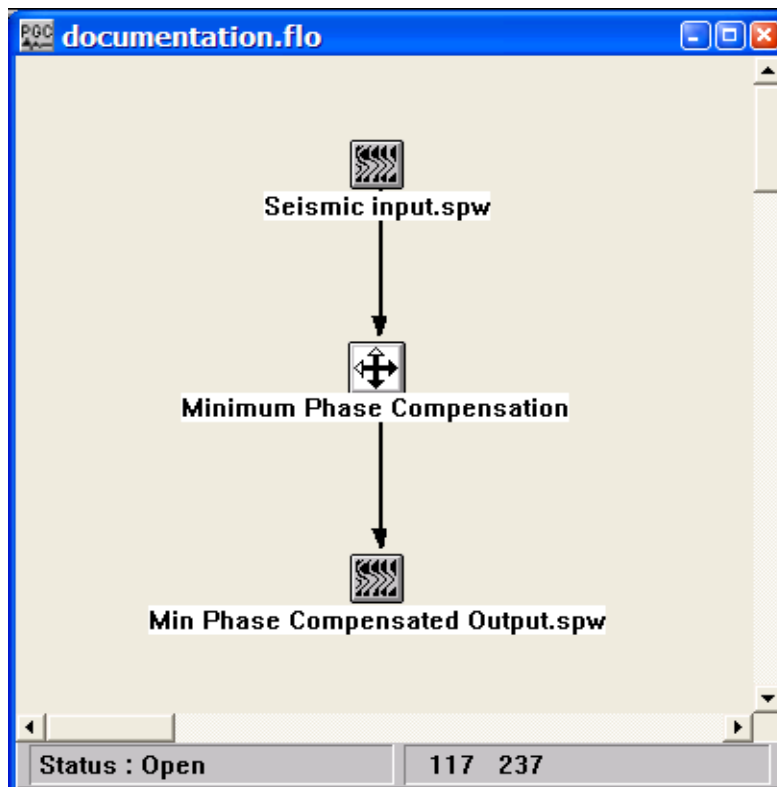
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data — recorded source signatures (optional).

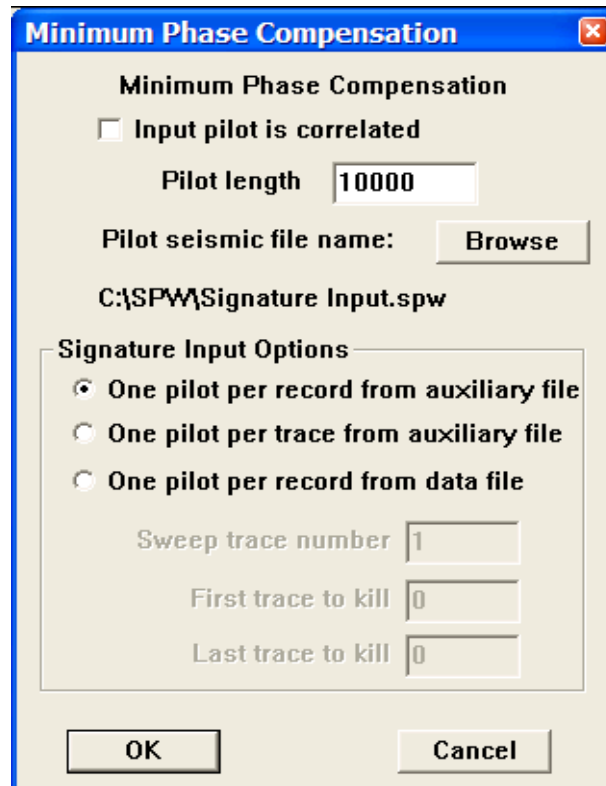
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Minimum Phase Compensation" and contains the following elements:

- A checkbox labeled "Input pilot is correlated" which is currently unchecked.
- A text field labeled "Pilot length" with the value "10000".
- A text field labeled "Pilot seismic file name:" followed by a "Browse" button.
- A text field showing the file path "C:\SPW\Signature Input.spw".
- A section titled "Signature Input Options" containing three radio buttons:
 - "One pilot per record from auxiliary file" (selected)
 - "One pilot per trace from auxiliary file"
 - "One pilot per record from data file"
- Below the radio buttons are three text fields:
 - "Sweep trace number" with the value "1".
 - "First trace to kill" with the value "0".
 - "Last trace to kill" with the value "0".
- At the bottom are "OK" and "Cancel" buttons.

Parameter Description:

Input pilot is correlated – If checked, indicates that the pilot trace containing the source signature used to design the minimum phase compensation filter is a correlated seismic trace.

Pilot length (ms) — Enter the length of the pilot in milliseconds.

Pilot seismic file name – Use the Browse button to select the auxiliary file contains the pilot/signature traces.

Signature Input Options — Select the method of accessing the signature.

One pilot per record from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential record. Therefore, number of pilot traces should equal the number of input records.

One pilot per trace from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential trace. Therefore, number of pilot traces should equal the number of input traces.

One pilot per record in the data file — This option uses one trace from each record as the pilot trace for that record.

Sweep trace number — Enter the trace number to use as the pilot.

First trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill the these auxiliary traces. Enter the first trace number to kill.

Last trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill the these auxiliary traces. Enter the last trace number to kill.

Offset Deconvolution

Usage:

The Offset Deconvolution step is a Wiener-Levinson based algorithm that allows you to decompose the offset response to account for changes in wavelet shape due to offset variable conditions. Both spiking and predictive deconvolution operators are available. You choose the amount of pre-whitening, the inverse filter length, the start time of your operator design window, and the design window length. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset. For the predictive deconvolution method, you must choose a predictive length for your wavelet. You also have the option of range limiting, by offset distance, the traces used in the design of the deconvolution operator.

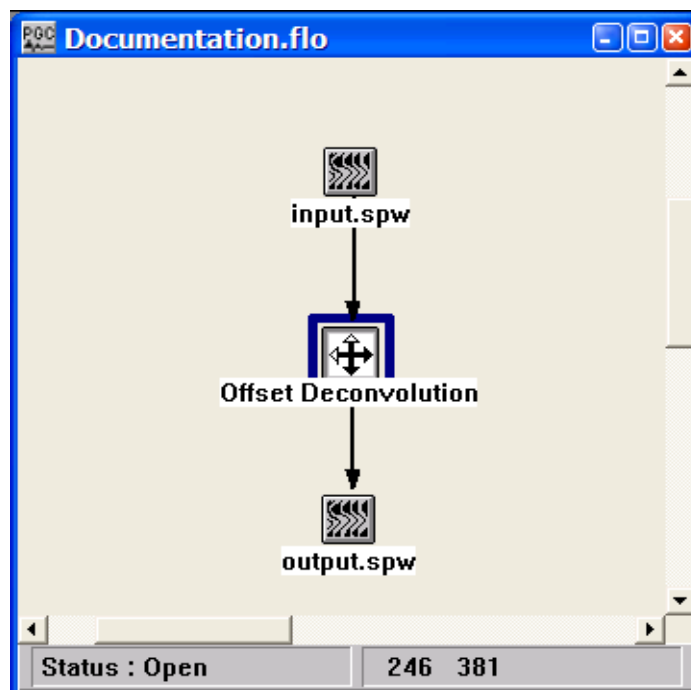
Input Links:

1) Seismic data in offset sort order (mandatory).

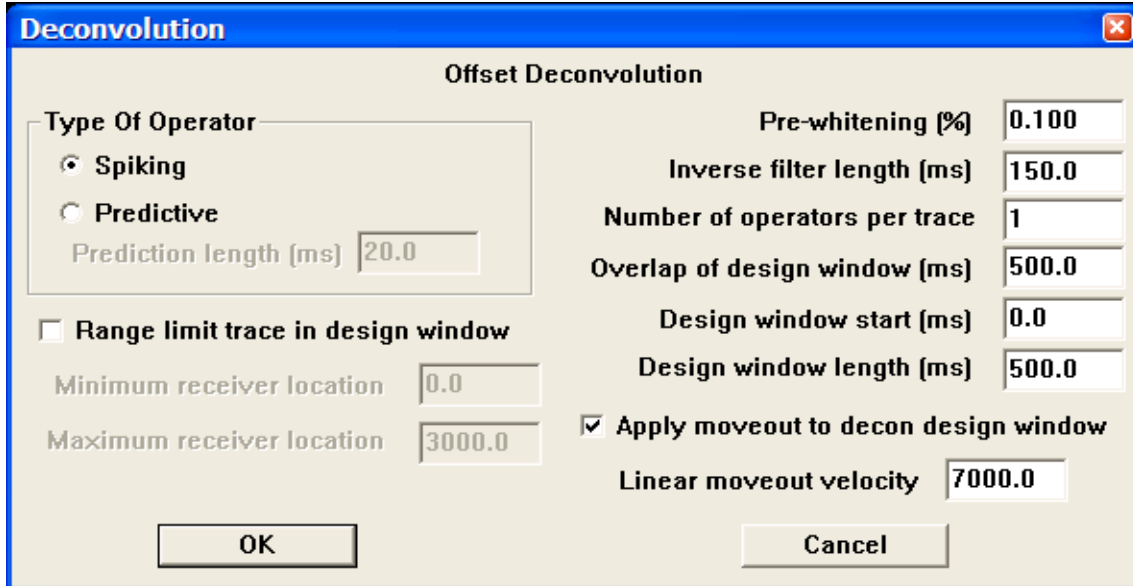
Output Links:

1) Seismic data in offset sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Deconvolution" with a subtitle "Offset Deconvolution". It contains two main sections. The left section, titled "Type Of Operator", has two radio buttons: "Spiking" (selected) and "Predictive". Below the "Predictive" button is a text input field for "Prediction length (ms)" with the value "20.0". There is also a checkbox for "Range limit trace in design window" which is unchecked. Below this checkbox are two text input fields: "Minimum receiver location" with the value "0.0" and "Maximum receiver location" with the value "3000.0". The right section contains several text input fields: "Pre-whitening (%)" with "0.100", "Inverse filter length (ms)" with "150.0", "Number of operators per trace" with "1", "Overlap of design window (ms)" with "500.0", "Design window start (ms)" with "0.0", and "Design window length (ms)" with "500.0". There is also a checked checkbox for "Apply moveout to decon design window" and a text input field for "Linear moveout velocity" with the value "7000.0". At the bottom of the dialog are "OK" and "Cancel" buttons.

Parameter	Value
Type Of Operator	Spiking
Prediction length (ms)	20.0
Range limit trace in design window	Unchecked
Minimum receiver location	0.0
Maximum receiver location	3000.0
Pre-whitening (%)	0.100
Inverse filter length (ms)	150.0
Number of operators per trace	1
Overlap of design window (ms)	500.0
Design window start (ms)	0.0
Design window length (ms)	500.0
Apply moveout to decon design window	Checked
Linear moveout velocity	7000.0

Parameter Description:

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Weiner-Levinson spiking deconvolution.

Predictive — Weiner-Levinson predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Pre-whitening percent — Enter the prewhitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Design window start (ms) — Enter the start time of the decon design window in milliseconds.

Design window length (ms) — Enter the length of the decon design window in milliseconds.

Apply moveout to decon design window — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Range limit trace in design window — If checked, the range of traces used to design the deconvolution operator may be limited by offset.

Minimum absolute offset — Enter the minimum absolute receiver trace to use in the design of the deconvolution operator.

Maximum absolute offset — Enter the maximum absolute receiver trace to use in the design of the deconvolution operator.

Receiver Deconvolution

Usage:

The Receiver Deconvolution step is a Weiner-Levinson based algorithm that allows you to decompose the receiver response to account for changes in wavelet shape due to near-receiver conditions. Both spiking and predictive deconvolution operators are available. You choose the amount of pre-whitening, the inverse filter length, the start time of you operator design window, and the design window length. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset. For the predictive deconvolution method, you must choose a predictive length for your wavelet. You also have the option of range limiting, by offset distance, the traces used in the design of the deconvolution operator.

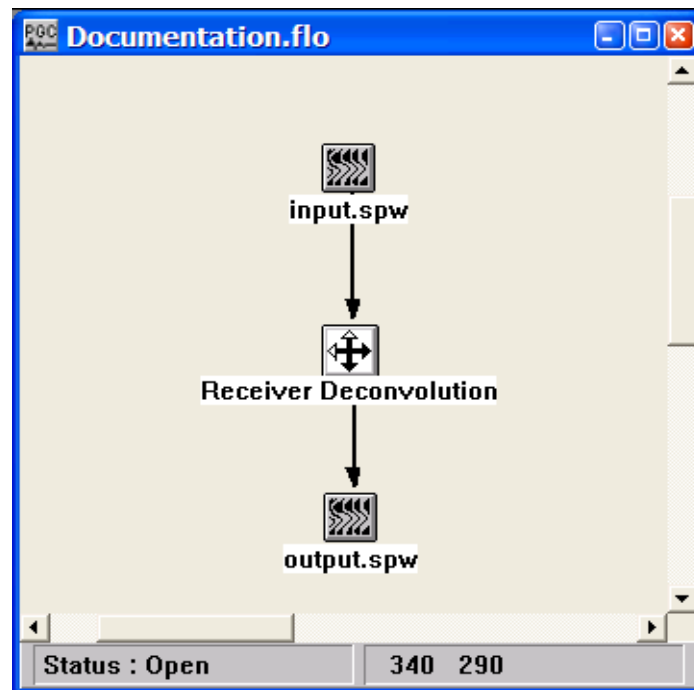
Input Links:

1) Seismic data in receiver sort order (mandatory).

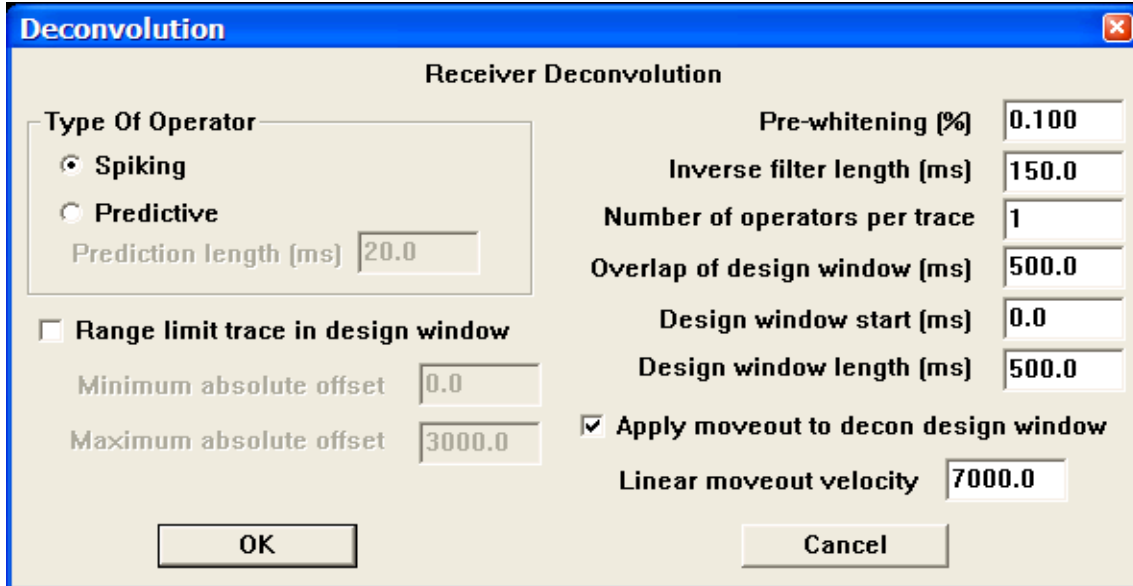
Output Links:

1) Seismic data in receiver sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Deconvolution" with a subtitle "Receiver Deconvolution". It contains several input fields and checkboxes for configuring deconvolution parameters. The "Type Of Operator" section has two radio buttons: "Spiking" (selected) and "Predictive". The "Predictive" option has a "Prediction length (ms)" field set to 20.0. A checkbox "Range limit trace in design window" is unchecked. Below it are "Minimum absolute offset" (0.0) and "Maximum absolute offset" (3000.0) fields. On the right, "Pre-whitening (%)" is 0.100, "Inverse filter length (ms)" is 150.0, "Number of operators per trace" is 1, "Overlap of design window (ms)" is 500.0, "Design window start (ms)" is 0.0, and "Design window length (ms)" is 500.0. A checked checkbox "Apply moveout to decon design window" has a "Linear moveout velocity" field set to 7000.0. "OK" and "Cancel" buttons are at the bottom.

Parameter	Value
Type Of Operator	Spiking
Prediction length (ms)	20.0
Range limit trace in design window	<input type="checkbox"/>
Minimum absolute offset	0.0
Maximum absolute offset	3000.0
Pre-whitening (%)	0.100
Inverse filter length (ms)	150.0
Number of operators per trace	1
Overlap of design window (ms)	500.0
Design window start (ms)	0.0
Design window length (ms)	500.0
Apply moveout to decon design window	<input checked="" type="checkbox"/>
Linear moveout velocity	7000.0

Parameter Description:

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Weiner-Levinson spiking deconvolution.

Predictive — Weiner-Levinson predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Pre-whitening percent — Enter the pre-whitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Design window start (ms) — Enter the start time of the decon design window in milliseconds.

Design window length (ms) — Enter the length of the decon design window in milliseconds.

Apply moveout to decon design window — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Range limit trace in design window — If checked, the range of traces used to design the deconvolution operator may be limited by offset.

Minimum absolute offset — Enter the minimum absolute offset trace to use in the design of the deconvolution operator.

Maximum absolute offset — Enter the maximum absolute offset trace to use in the design of the deconvolution operator.

Source Deconvolution

Usage:

The Source Deconvolution step is a Wiener-Levinson based algorithm that allows you to decompose the source response to account for changes in wavelet shape due to near-source conditions. Both spiking and predictive deconvolution operators are available. You choose the amount of pre-whitening, the inverse filter length, the start time of your operator design window, and the design window length. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset. For the predictive deconvolution method, you must choose a predictive length for your wavelet. You also have the option of range limiting, by offset distance, the traces used in the design of the deconvolution operator.

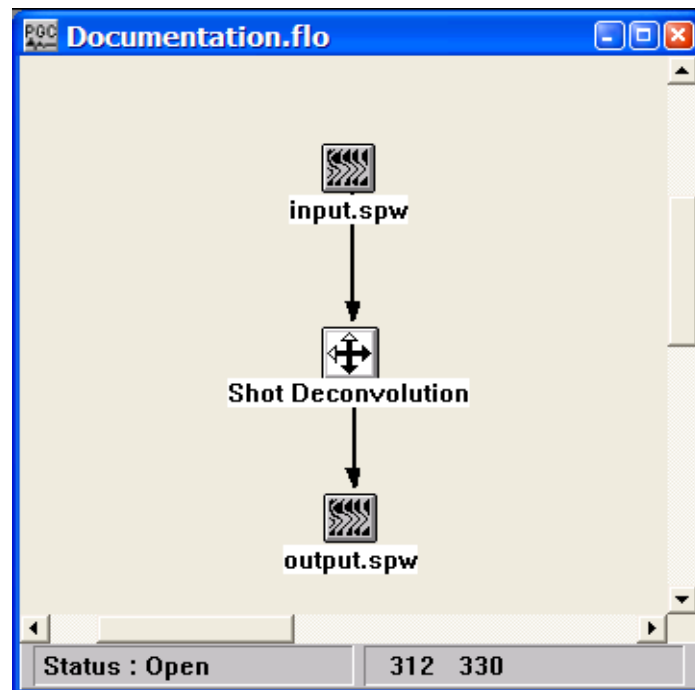
Input Links:

1) Seismic data in source (shot) sort order (mandatory).

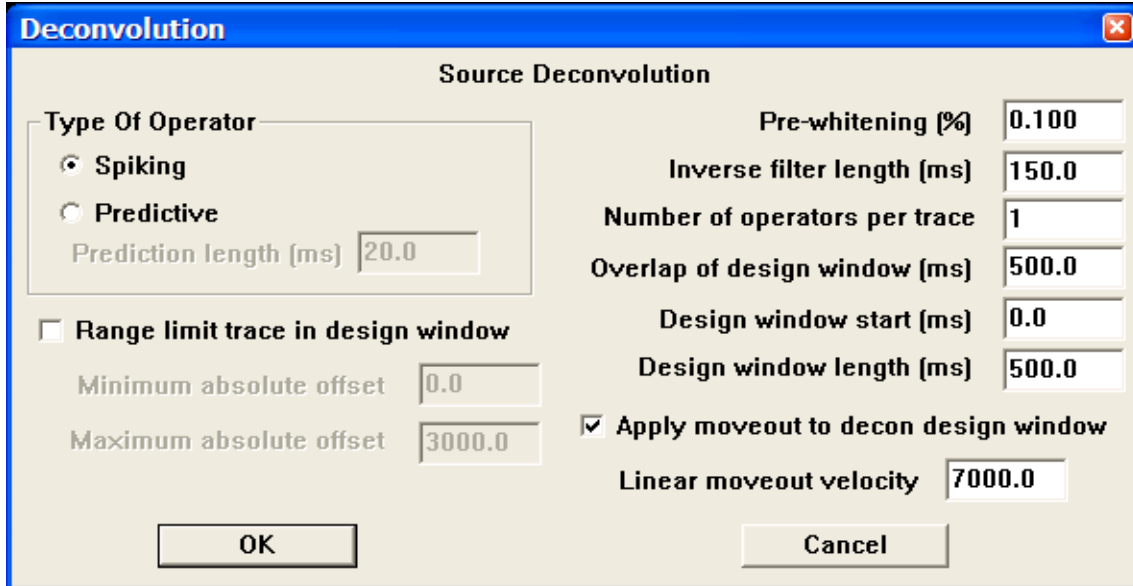
Output Links:

1) Seismic data in source (shot) sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The image shows a software dialog box titled "Deconvolution" with a sub-header "Source Deconvolution". It contains two main sections. The left section, "Type Of Operator", has two radio buttons: "Spiking" (selected) and "Predictive". Below "Predictive" is a text field for "Prediction length (ms)" with the value "20.0". There is also a checkbox for "Range limit trace in design window" which is unchecked. Below this are two text fields: "Minimum absolute offset" with "0.0" and "Maximum absolute offset" with "3000.0". The right section contains several text fields: "Pre-whitening (%)" with "0.100", "Inverse filter length (ms)" with "150.0", "Number of operators per trace" with "1", "Overlap of design window (ms)" with "500.0", "Design window start (ms)" with "0.0", and "Design window length (ms)" with "500.0". There is a checked checkbox for "Apply moveout to decon design window" and a text field for "Linear moveout velocity" with "7000.0". At the bottom are "OK" and "Cancel" buttons.

Source Deconvolution	
Type Of Operator	Pre-whitening (%)
<input checked="" type="radio"/> Spiking	0.100
<input type="radio"/> Predictive	Inverse filter length (ms)
Prediction length (ms) 20.0	150.0
<input type="checkbox"/> Range limit trace in design window	Number of operators per trace
Minimum absolute offset 0.0	1
Maximum absolute offset 3000.0	Overlap of design window (ms)
	500.0
	Design window start (ms)
	0.0
	Design window length (ms)
	500.0
	<input checked="" type="checkbox"/> Apply moveout to decon design window
	Linear moveout velocity
	7000.0

Parameter Description:

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Weiner-Levinson spiking deconvolution.

Predictive — Weiner-Levinson predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Pre-whitening percent — Enter the prewhitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Design window start (ms) — Enter the start time of the decon design window in milliseconds.

Design window length (ms) — Enter the length of the decon design window in milliseconds.

Apply moveout to decon design window — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Range limit trace in design window — If checked, the range of traces used to design the deconvolution operator may be limited by offset.

Minimum absolute offset — Enter the minimum absolute offset trace to use in the design of the deconvolution operator.

Maximum absolute offset — Enter the maximum absolute offset trace to use in the design of the deconvolution operator.

Signature Deconvolution

Usage:

Signature Deconvolution allows you to remove a seismic signature from your data traces by calculating the inverse of a supplied signature trace and then filtering your data by this signature inverse. This is a common technique for use in processing marine data to remove the signature of the airguns.

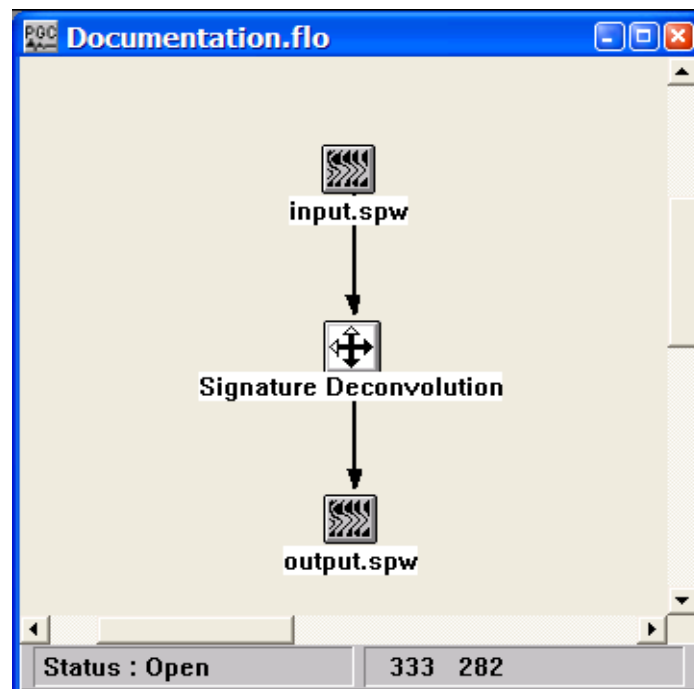
Input Links:

1) Seismic data in any sort order (mandatory).

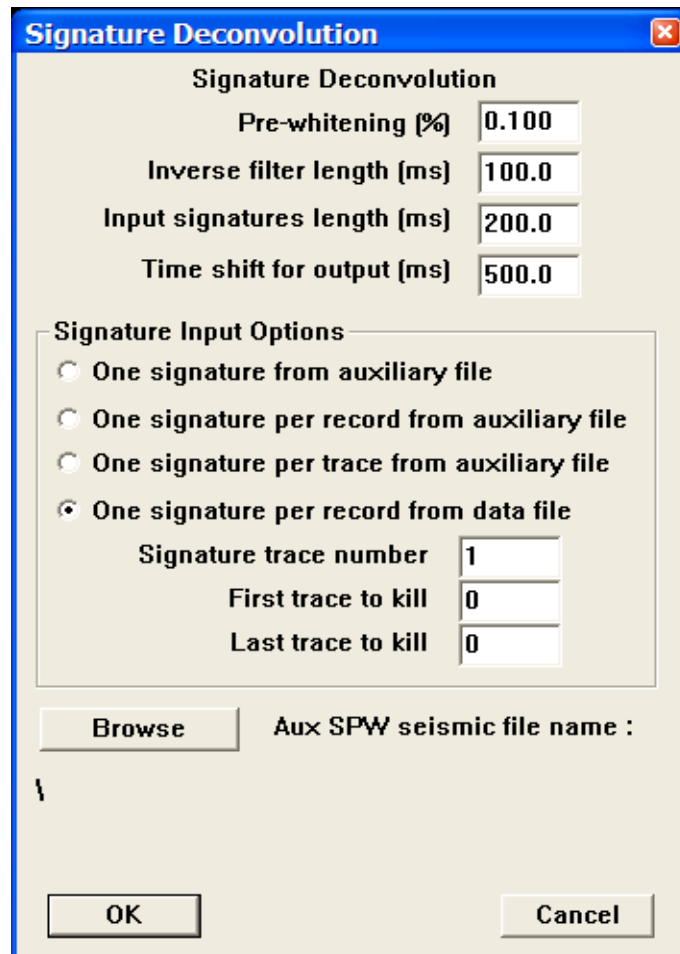
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Signature Deconvolution" and contains the following fields and options:

- Signature Deconvolution**
 - Pre-whitening (%): 0.100
 - Inverse filter length (ms): 100.0
 - Input signatures length (ms): 200.0
 - Time shift for output (ms): 500.0
- Signature Input Options**
 - ☐ One signature from auxiliary file
 - ☐ One signature per record from auxiliary file
 - ☐ One signature per trace from auxiliary file
 - ☒ One signature per record from data file
- Signature trace number**: 1
- First trace to kill**: 0
- Last trace to kill**: 0
- Browse** button
- Aux SPW seismic file name**: \
- OK** and **Cancel** buttons

Parameter Description:

Pre-whitening percent — Enter the prewhitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Input signature length (ms) — Enter the length of the input signatures in milliseconds.

Time shift for output (ms) — Enter the time shift for the output trace following signature deconvolution

Signature Input Options — Select the data input source of the signature trace or traces.

One signature from an auxiliary file — This option inputs one signature trace from an auxiliary input data and uses that trace as the signature trace for the entire data set.

One signature per record from an auxiliary data file — This option inputs one signature trace per record from an auxiliary input data set and uses that trace as the signature trace for all traces in the record in the signature deconvolution calculation.

One signature per trace from an auxiliary data file — This option inputs one signature trace from an auxiliary input data set per data trace and uses that trace as the signature trace for the corresponding data trace in the signature deconvolution calculation.

One signature per record in the data file — This option uses one trace from each data record and uses that trace as the signature trace for all seismic traces in the record in the signature deconvolution calculation.

Signature trace number — Enter the trace number to use as the signature trace.

First trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the signature trace, you may wish to kill the these auxiliary traces. Enter the first trace number to kill.

Last trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the signature trace, you may wish to kill the these auxiliary traces. Enter the last trace number to kill.

Browse — Select this button to set the input auxiliary file containing the signatures.

Spectral Whitening

Usage:

The Spectral Whitening step is a multi-banded spectral whitening method for balancing the energy of the selected frequency bands of your data. You specify the beginning and ending frequencies in the pass zone, the number of bands within this zone, and the length of the AGC operator. The individual band-pass filter cut off values are linearly interpolated based on the low and high pass frequencies and the number of bands that you choose. Each band is given a Butterworth third order slope with the midpoints of each slope being the half power points. Within each band every trace is AGC'ed with respect to the maximum amplitude in the window. All AGC'ed bands are then summed. Optionally, you may specify the Low Cut / Low Pass / High Pass / High Cut (LC,LP,HP,HC) filter points and associated weights for summing of up to ten filter bands. For optimal balancing of the energy of your frequency bands, your filters should be designed such that the slopes of your filters exactly overlap as is illustrated below. Such a design optimally flattens the spectrum of your data without distorting the spectrum.

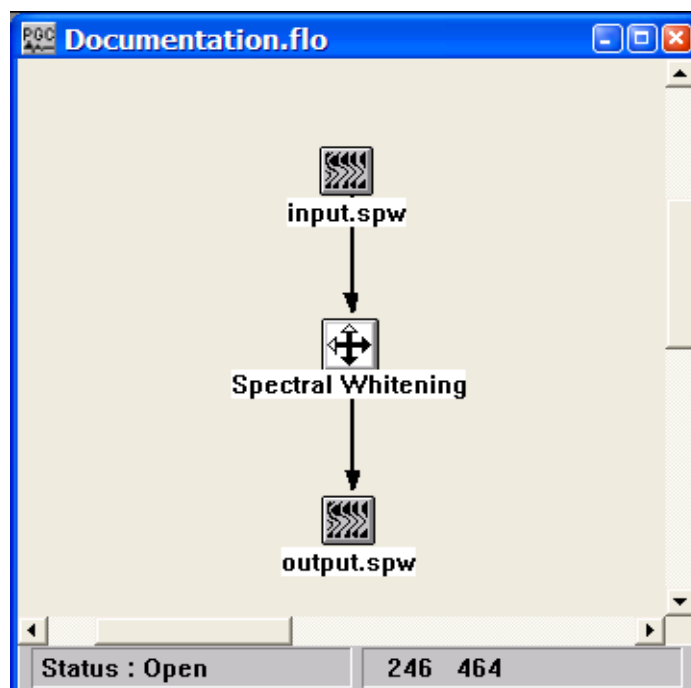
Input Links:

1) Seismic data in any sort order (mandatory).

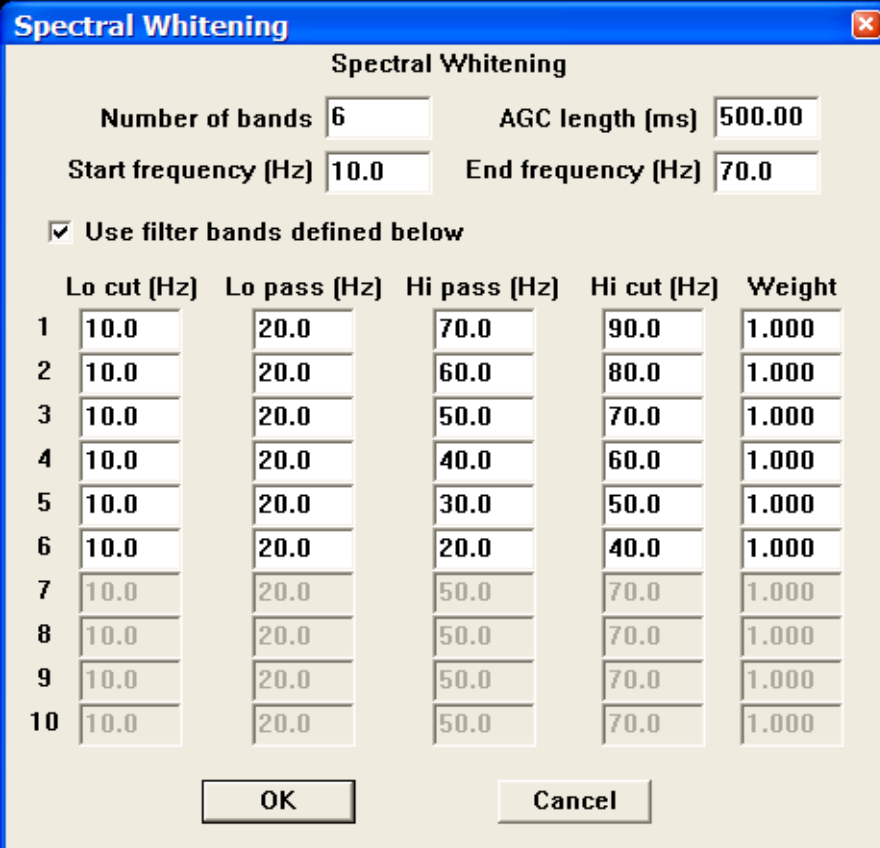
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Spectral Whitening" and contains several input fields and a table. At the top, there are four input fields: "Number of bands" (6), "AGC length (ms)" (500.00), "Start frequency (Hz)" (10.0), and "End frequency (Hz)" (70.0). Below these is a checked checkbox labeled "Use filter bands defined below". Under the checkbox is a table with 5 columns: "Lo cut (Hz)", "Lo pass (Hz)", "Hi pass (Hz)", "Hi cut (Hz)", and "Weight". The table has 10 rows, numbered 1 to 10. At the bottom of the dialog are "OK" and "Cancel" buttons.

	Lo cut (Hz)	Lo pass (Hz)	Hi pass (Hz)	Hi cut (Hz)	Weight
1	10.0	20.0	70.0	90.0	1.000
2	10.0	20.0	60.0	80.0	1.000
3	10.0	20.0	50.0	70.0	1.000
4	10.0	20.0	40.0	60.0	1.000
5	10.0	20.0	30.0	50.0	1.000
6	10.0	20.0	20.0	40.0	1.000
7	10.0	20.0	50.0	70.0	1.000
8	10.0	20.0	50.0	70.0	1.000
9	10.0	20.0	50.0	70.0	1.000
10	10.0	20.0	50.0	70.0	1.000

Parameter Description:

Start pass frequency (Hz) — Enter the low frequency pass band limit in hertz (Hz). This is the lowest frequency in the pass band.

End pass frequency (Hz) — Enter the high frequency pass band limit in hertz (Hz). This is the highest frequency in the pass band. It may not exceed one-half the Nyquist frequency.

Number of spectral bands — Enter the number of frequency bands. Each trace is split into this number of frequency bands which are AGC'ed and then summed to create the output trace.

Length of AGC operator (ms) — Enter the AGC operator length. This is the length of the AGC operator, which is applied to each frequency band.

Use filter bands defined below — If checked, the entered filter bands specified by the low cut, low pass, high pass, high cut and filter weight will be used.

Lo Cut — Enter the filter low frequency cutoff point in hertz (Hz).

Lo Pass — Enter the filter low frequency pass point in hertz (Hz).

High Pass — Enter the filter high frequency pass point in hertz (Hz).

High Cut — Enter the filter high frequency cutoff point in hertz (Hz).

Weight — Enter the filter band relative weight.

Surface Consistent Deconvolution

Usage:

The Surface Consistent Deconvolution step uses a Gauss-Seidel iterative method to perform a four-component surface-consistent decomposition of the amplitude spectra of the input seismic data into source, receiver, offset, and CMP components. Deconvolution operators are constructed from the source and receiver components of this decomposition. These operators are applied with the Apply Deconvolution Operators step. The user specifies whether the deconvolution will be of the spiking or predictive type, the design window, operator length, and percent white noise.

Input Links:

- 1) Seismic data in any sort order (mandatory).

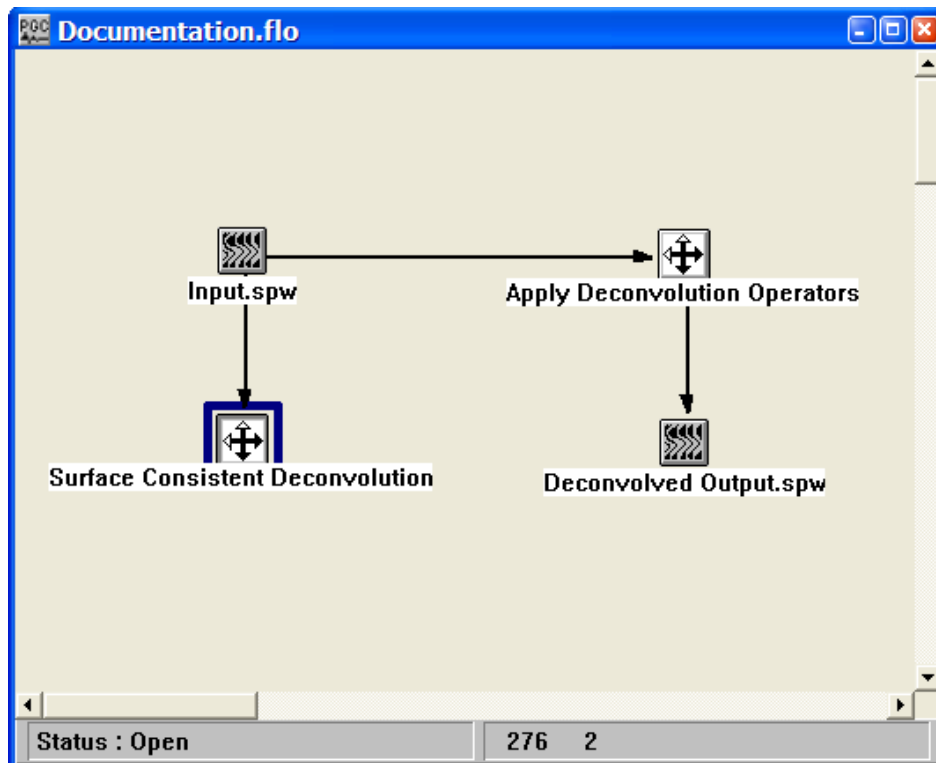
Output Links:

- 1) None. The surface-consistent deconvolution operators are output to an auxiliary disc file.

Reference:

Cary, P. M., and Lorentz, G. A., 1993, Four-component surface-consistent deconvolution: Geophysics, **58**, 383-392.

Example Flowchart:



Step Parameter Dialog:

Surface Consistent Deconvolution

Surface Consistent Deconvolution

Gauss-Seidel Iteration Parameters

Number of iterations

☐ End iteration based on amplitude difference

Amplitude difference for exit

Type Of Operator

☒ Spiking

☐ Predictive

Prediction length (ms)

Range Limit

☒ Range limit trace in design window

Minimum offset

Maximum offset

Deconvolution Parameters

Pre-whitening (%)

Inverse filter length (ms)

Design window start (ms)

Design window length (ms)

Linear Moveout

☒ Apply moveout to decon design window

Linear moveout velocity

☒ Verbose console mode

Output operator SPW filename:

Parameter Description:

Gauss-Seidel Iteration Parameters

Number of iterations — Specify the number of iterations performed in the Gauss-Seidel decomposition of the amplitude spectra.

End iteration based on amplitude difference — If checked, the step will continue until changes in component amplitudes from one iteration to the next do not exceed a user specified value.

Amplitude difference for exit - Specify the value.

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Spiking deconvolution.

Predictive — Predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Range Limit

Range limit trace in design window — If checked, the range of traces used to design the deconvolution operator may be limited by offset.

Minimum absolute offset — Enter the minimum absolute offset trace to use in the design of the deconvolution operator.

Maximum absolute offset — Enter the maximum absolute offset trace to use in the design of the deconvolution operator.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Deconvolution Parameters

Pre-whitening percent — Enter the pre-whitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Design window start (ms) — Enter the start time of the deconvolution design window in milliseconds.

Design window length (ms) — Enter the length of the deconvolution design window in milliseconds.

Time-Variant Deconvolution

Usage:

The Deconvolution step is a Wiener-Levinson algorithm for applying either spiking or predictive multi-gate deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of each operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset.

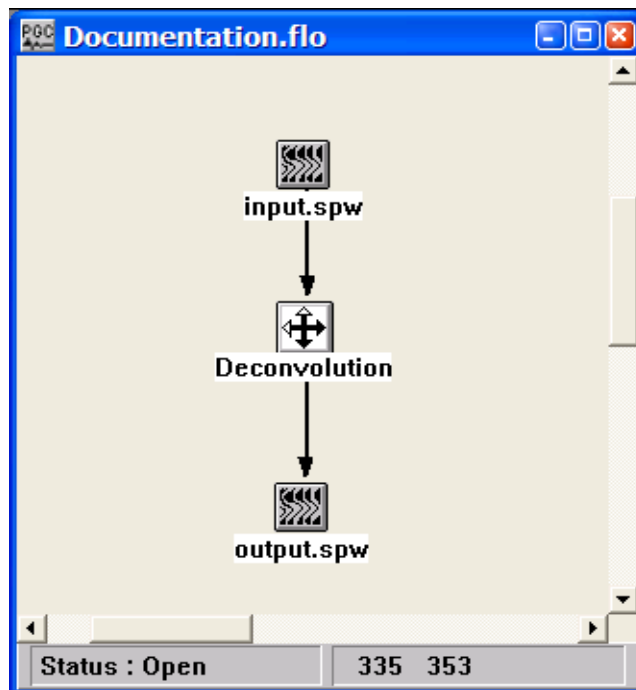
Input Links:

2) Seismic data in any sort order (mandatory).

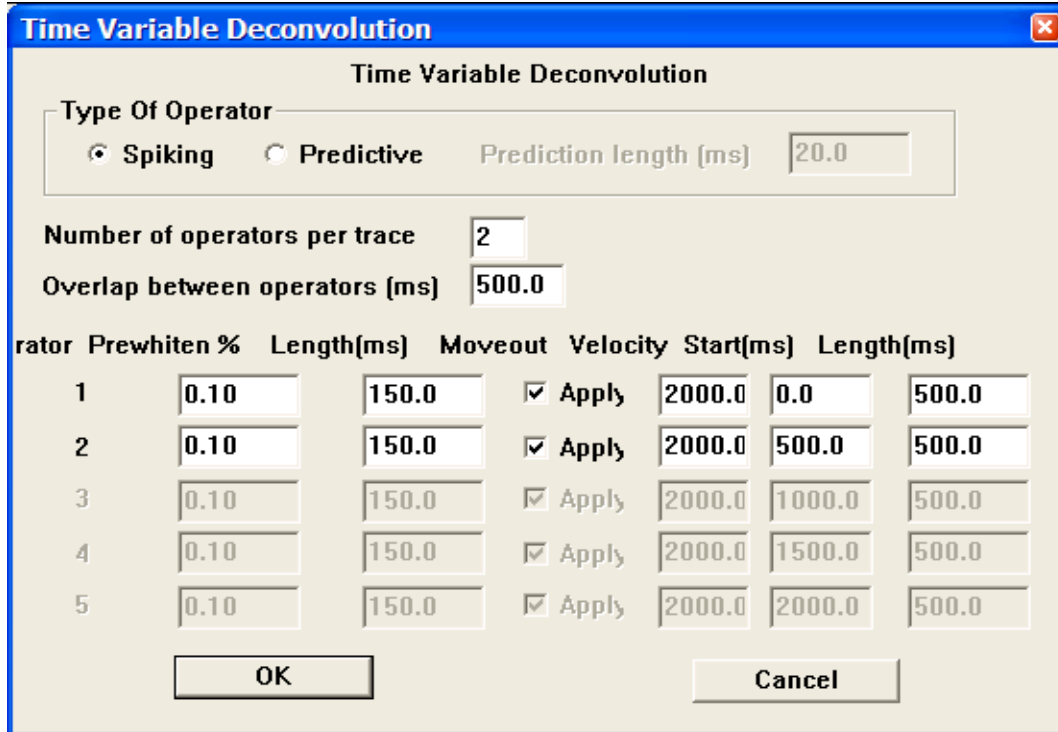
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Time Variable Deconvolution". It contains the following controls:

- Type Of Operator:** Two radio buttons, "Spiking" (selected) and "Predictive". A text field for "Prediction length (ms)" is set to 20.0.
- Number of operators per trace:** A text field set to 2.
- Overlap between operators (ms):** A text field set to 500.0.
- Table:** A table with 7 columns: "rator", "Prewhitened %", "Length(ms)", "Moveout", "Velocity", "Start(ms)", and "Length(ms)". It contains 5 rows of data.
- Buttons:** "OK" and "Cancel" buttons at the bottom.

rator	Prewhitened %	Length(ms)	Moveout	Velocity	Start(ms)	Length(ms)	
1	0.10	150.0	<input checked="" type="checkbox"/>	Apply	2000.0	0.0	500.0
2	0.10	150.0	<input checked="" type="checkbox"/>	Apply	2000.0	500.0	500.0
3	0.10	150.0	<input checked="" type="checkbox"/>	Apply	2000.0	1000.0	500.0
4	0.10	150.0	<input checked="" type="checkbox"/>	Apply	2000.0	1500.0	500.0
5	0.10	150.0	<input checked="" type="checkbox"/>	Apply	2000.0	2000.0	500.0

Parameter Description:

Type of Operator — Select type of deconvolution to perform: Spiking or Predictive.

Spiking — Wiener-Levinson spiking deconvolution.

Predictive — Wiener-Levinson predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Number of operators per trace — Enter the number of separate deconvolution inverse filters to calculate per trace.

Overlap of design window (ms) — Enter the overlap in milliseconds between operators. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

For each design gate, enter:

Pre-whitening percent — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the inverse filter to be calculated and applied in milliseconds.

Apply moveout to decon design window — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Linear moveout velocity — Enter the linear moveout of the deconvolution design window.

Design window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Design window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Wavelet Estimation – Seismic Only

Usage:

The Wavelet Estimation – Seismic Only step estimates the seismic source wavelet from the input seismic data. The amplitude spectrum of the source wavelet is derived from the averaged autocorrelations of the input data, while the minimum-phase spectrum of the source wavelet is derived from the Hilbert transform of the logarithmic amplitude spectrum. The input data are assumed to be minimum phase. You set the wavelet length and choose the data window from which the wavelet is extracted. A small amount of white noise can be added to the computed amplitude spectrum to stabilize the results.

Input Links:

- 1) Seismic data in any sort order (mandatory).

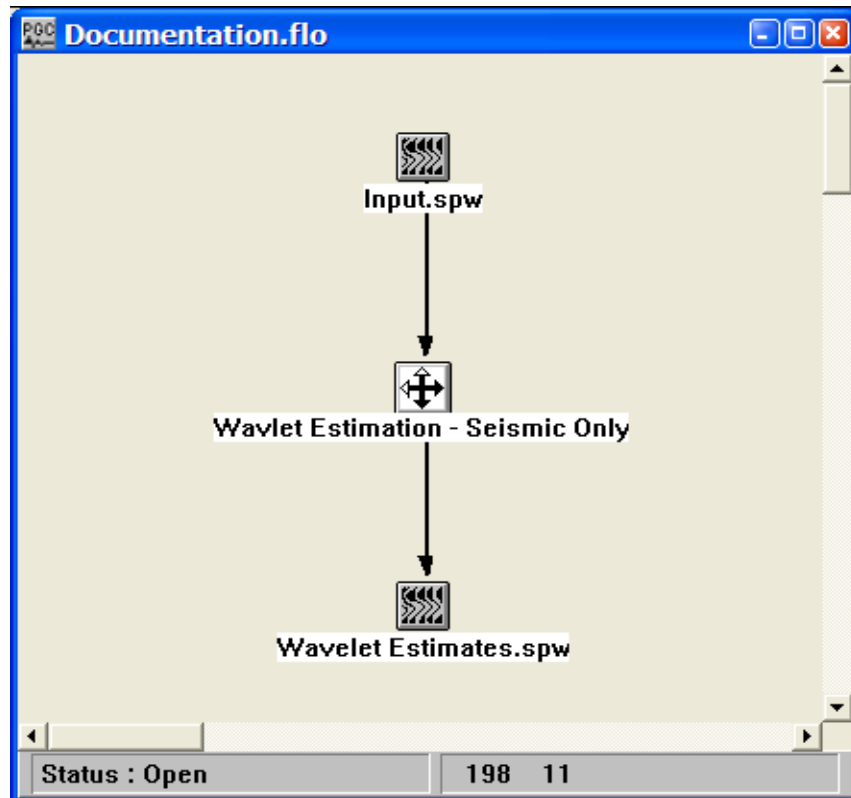
Output Links:

- 1) Seismic data (mandatory).

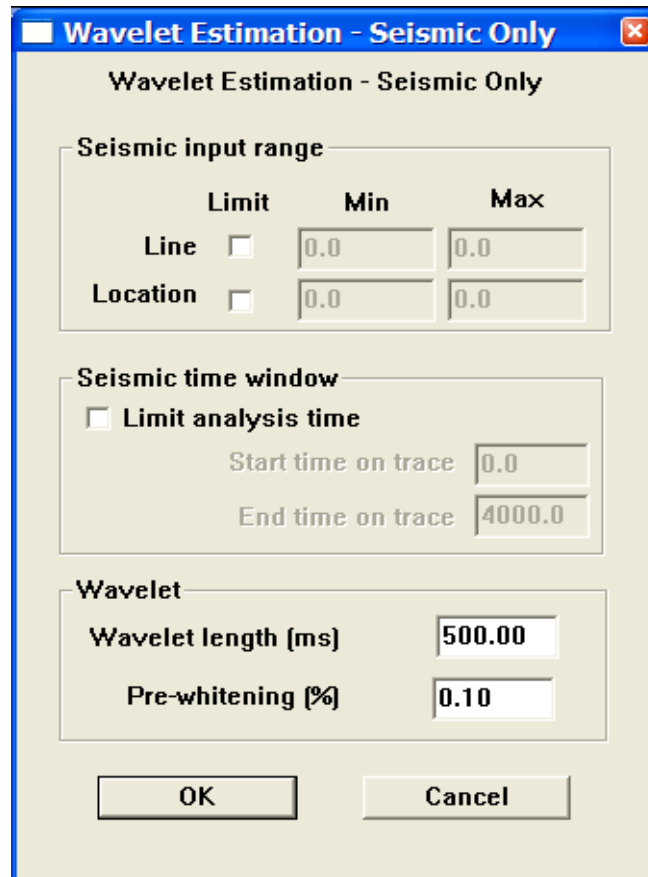
Reference:

White, R. E., and O'Brien, P. N. S., 1993, Estimation of the primary seismic pulse: Geophysical Prospecting, **22**, 627-651.

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Wavelet Estimation - Seismic Only" and contains three main sections: "Seismic input range", "Seismic time window", and "Wavelet".

Seismic input range

	Limit	Min	Max
Line	<input type="checkbox"/>	0.0	0.0
Location	<input type="checkbox"/>	0.0	0.0

Seismic time window

☐ Limit analysis time

Start time on trace: 0.0

End time on trace: 4000.0

Wavelet

Wavelet length (ms): 500.00

Pre-whitening (%): 0.10

Buttons: OK, Cancel

Parameter Description:

Seismic input range – Allows the wavelet to be extracted from a limited spatial zone of the input data.

Line – If checked, allows you to limit the range of CMP lines used to extract the wavelet.

Min – Minimum CMP line number to input.

Max – Maximum CMP line number to input.

Location – If checked, allows you to limit the range of CMP locations used to extract the wavelet.

Min – Minimum CMP location number to input.

Max – Maximum CMP location number to input.

Seismic time window – If checked, allows the wavelet to be extracted from a limited temporal zone of the input data.

Start time on trace – Enter the start time for analysis.

End time on trace – Enter the end time for analysis.

Wavelet length (ms) – Enter the length of the output seismic wavelet.

Pre-whitening (%) – Enter the percent pre-whitening that will be used to stabilize the computation of the phase spectrum.

Wavelet Estimation – Seismic + Well

Usage:

The Wavelet Estimation – Seismic + Well step estimates the seismic source wavelet from the combination of a well log derived reflectivity sequence and the adjacent post-stack seismic data. The step allows the wavelet to be derived by either the Fourier Division or the Wiener Filtering methods. The input data are assumed to be minimum phase. You set the wavelet length and choose the data window from which the wavelet is extracted. A small amount of white noise can be added to the computed amplitude spectrum to stabilize the results.

Input Links:

2) Seismic data in any sort order (mandatory).

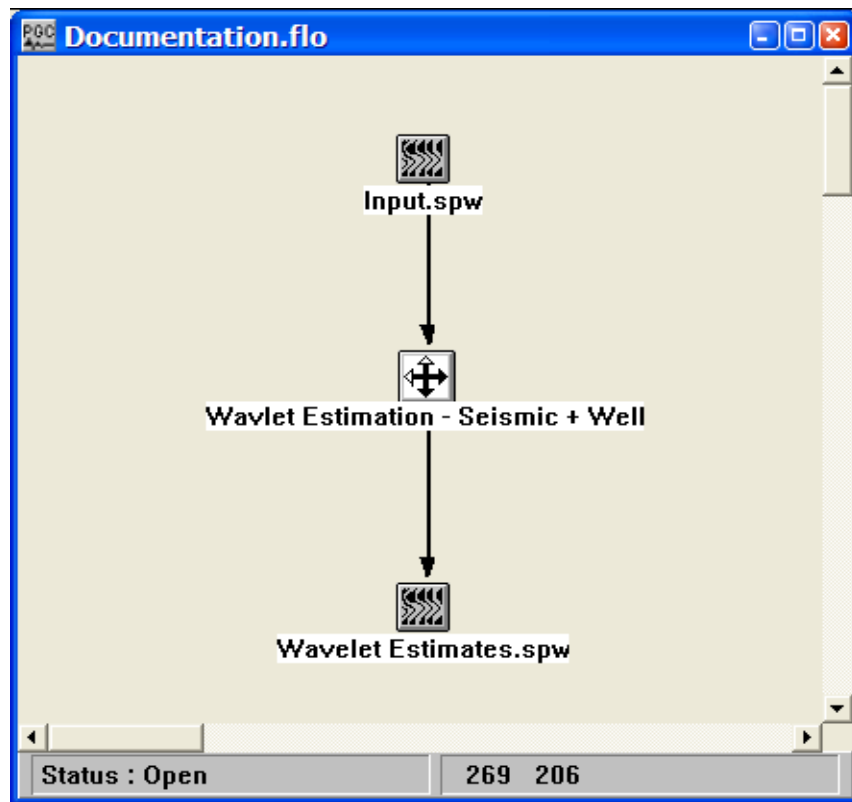
Output Links:

2) Seismic data (mandatory).

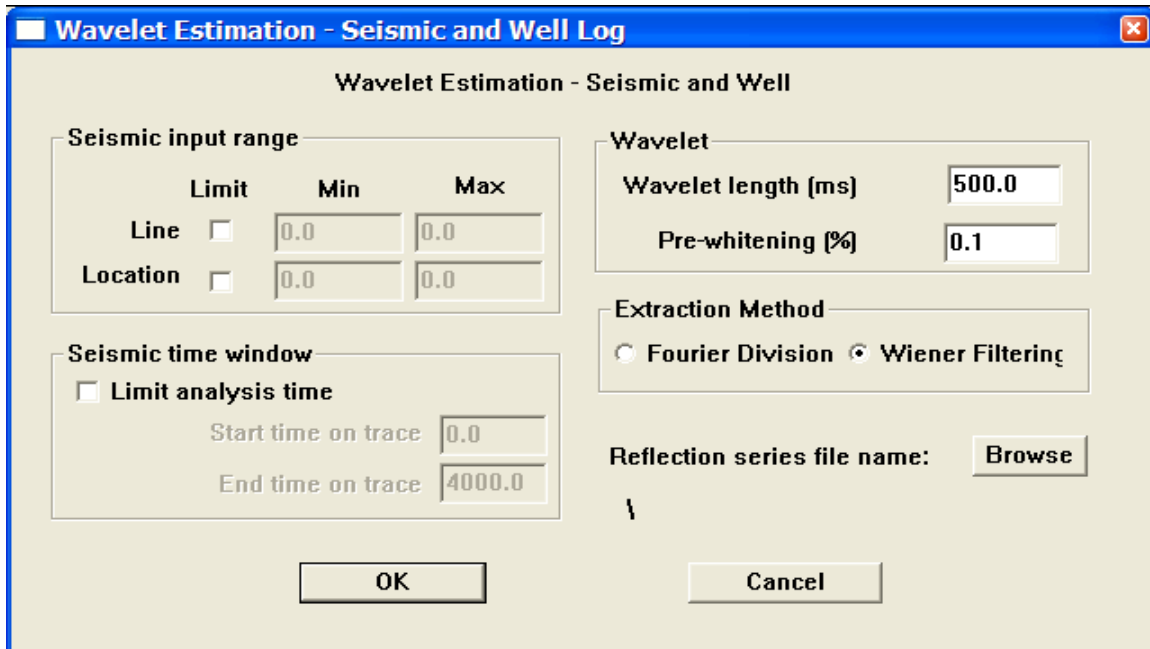
Reference:

Danielsen, V., and Karlsson, T. V., 1984, Extraction of signatures from seismic and well data: First Break, 2.

Example Flowchart:



Step Parameter Dialog:



The dialog box is titled "Wavelet Estimation - Seismic and Well Log". It contains several sections for parameter configuration:

- Seismic input range:** A table with columns "Limit", "Min", and "Max".

	Limit	Min	Max
Line	<input type="checkbox"/>	0.0	0.0
Location	<input type="checkbox"/>	0.0	0.0
- Wavelet:** Two input fields: "Wavelet length (ms)" with value 500.0 and "Pre-whitening (%)" with value 0.1.
- Extraction Method:** Two radio buttons: "Fourier Division" (unselected) and "Wiener Filtering" (selected).
- Seismic time window:** A checkbox "Limit analysis time" is unchecked. Below it are two input fields: "Start time on trace" (0.0) and "End time on trace" (4000.0).
- Reflection series file name:** A text field with a "Browse" button.

At the bottom are "OK" and "Cancel" buttons.

Parameter Description:

Seismic input range – Allows the wavelet to be extracted from a limited spatial zone of the input data.

Line – If checked, allows you to limit the range of CMP lines used to extract the wavelet.

Min – Minimum CMP line number to input.

Max – Maximum CMP line number to input.

Location – If checked, allows you to limit the range of CMP locations used to extract the wavelet.

Min – Minimum CMP location number to input.

Max – Maximum CMP location number to input.

Seismic time window – If checked, allows the wavelet to be extracted from a limited temporal zone of the input data.

Start time on trace – Enter the start time for analysis.

End time on trace – Enter the end time for analysis.

Wavelet length (ms) – Enter the length of the output seismic wavelet.

Pre-whitening (%) – Enter the percent pre-whitening that will be used to stabilize the computation of the phase spectrum.

Extraction Method – Select the method used to extract the source wavelet from the seismic and well log.

Fourier – The amplitude spectrum of the source wavelet is computed as the quotient of the Fourier transform of the seismic trace(s) at the well location and the Fourier transform of the reflectivity series derived from appropriate well-log data. The phase spectrum

Wiener – A least-square Wiener filter is computed that transforms the reflectivity series derived from appropriate well-log data into the seismic trace(s) at the well location.